UNITED STATES ARMY
AVIATION DIGEST
JULY 1986

A TOTAL SYSTEM FOR BATTLE

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Major General Ellis D. Parker
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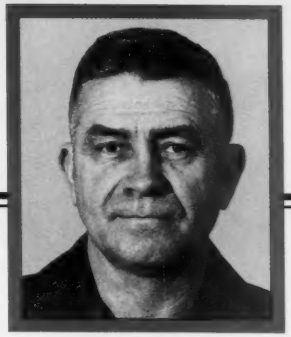


Army Flight Simulation

AS ARMY AIRCRAFT increase in sophistication, training Army aviators to fight and win on the battlefield of tomorrow becomes an increasingly complex and expensive task. While it was once possible to train aviators to proficiency solely using the aircraft, the cost to fly and maintain today's aircraft, combined with the hazardous nature of Army flight profiles, have forced us to find other means of training. Flight simulation is the answer.

In early 1962, the Army purchased its first computerized simulator in the form of the GAT 2 (general aviation trainer). This trainer simulated flight, engine and other aircraft systems; it allowed individual and crew training in emergency and radio navigation procedures as well as basic flight tasks. The GAT 2 was the Army's first modern flight simulator. Its success led to a realization of the cost and training benefits available from high fidelity flight simulation. To take advantage of these benefits, the synthetic flight training system (SFTS) was conceived.

It was 10 years between the purchase of the GAT 2 and the fielding of the first component of the SFTS—the UH-1H Huey simulator. This device provides individual and crew training in emergency and instrument flight procedures and represents a vast improvement over the GAT 2. It brings the benefits of simulation to aviators in the field.

Additional components in the SFTS have continued the precedent set by the UH-1H simulator, providing unit commanders a substantially expanded array of training opportunities. The CH-47 Chinook flight simulator, UH-60 Black Hawk flight simulator and the AH-1S Cobra flight and weapons simulator have improved upon the UH-1H by including out-the-window visual scenes to allow day/night training of all mission tasks. These simulators also provide threat targets capable of activating the aircraft electronic countermeasure equipment.

The newest addition to the synthetic flight training system, the AH-64 combat mission simulator, goes one step beyond the capabilities of other SFTS components by providing a fully interactive threat. This threat can engage the pilot using actual threat weapons and electronic countermeasures capabilities.

The success of the SFTS in training individual aviators and crews has led to an expansion of the scope of simulation training. Devices are now being developed to allow training of team, company and battalion-size units. The evolution of Army Aviation tactics and doctrine also is causing changes in both training strategies and simulation technology.

The feasibility of networking simulators in different geographic locations, using high-speed telecommunications, is being studied. Advanced visual systems are being developed to allow air-to-air combat training as well as representation of specific geographic areas.

Simulation is the way of the future. As technological changes and Army Aviation tactics and doctrine develop, flight simulation will continue to enhance the training and development of an effective fighting force. Army Aviation is and will continue to be prepared to meet the threat of tomorrow.

AH-64

A TOTAL SYSTEM FOR BATTLE

The Army's AH-64 Apache is the most survivable and advanced attack helicopter in the world. Its ability to perform antiarmor operations in day, night and adverse weather conditions renders the Apache unequivocably unique. Whether employed independently or as an integral part of the air-land battle team, the AH-64 Apache's credentials make its presence essential if we're going to fight and win on today's modern air-land battlefield. This series continues in the September issue.

MONTHLY WRITING AWARD

Mr. Norman B. Hirsh
Executive Vice President—Program Management
McDonnell Douglas Helicopter Company

THE AH-64 APACHE attack helicopter is in production and moving to the field. The training base has been established at Ft. Rucker, AL; Ft. Eustis, VA; and Ft. Gordon, GA. The single point fielding station at Ft. Hood, TX, was initiated in February 1986. It will be the focal point in conducting unit assembly, tables of organization and equipment issue, unit training and fielding of all AH-64 units.

The fielding of the most capable weapons platform in the world has stimulated universal interest among Army aviators. This is the first of a series of articles to follow that are designed to satisfy that interest. It is an introduction and overview of the AH-64 Apache. Subsequent articles will focus on selected aircraft systems and subsystems to provide more detailed information.

The primary mission of the AH-64 Apache requires engagement and defeat of enemy armor in day, night and adverse weather. This helicopter's mobility, firepower and ability to detect, recognize and engage multiple targets provides the responsiveness and flexibility required by today's battlefield commanders.

In addition to combating armor, other missions include: covering force, flank security, economy of force, airmobile escort and area suppression.

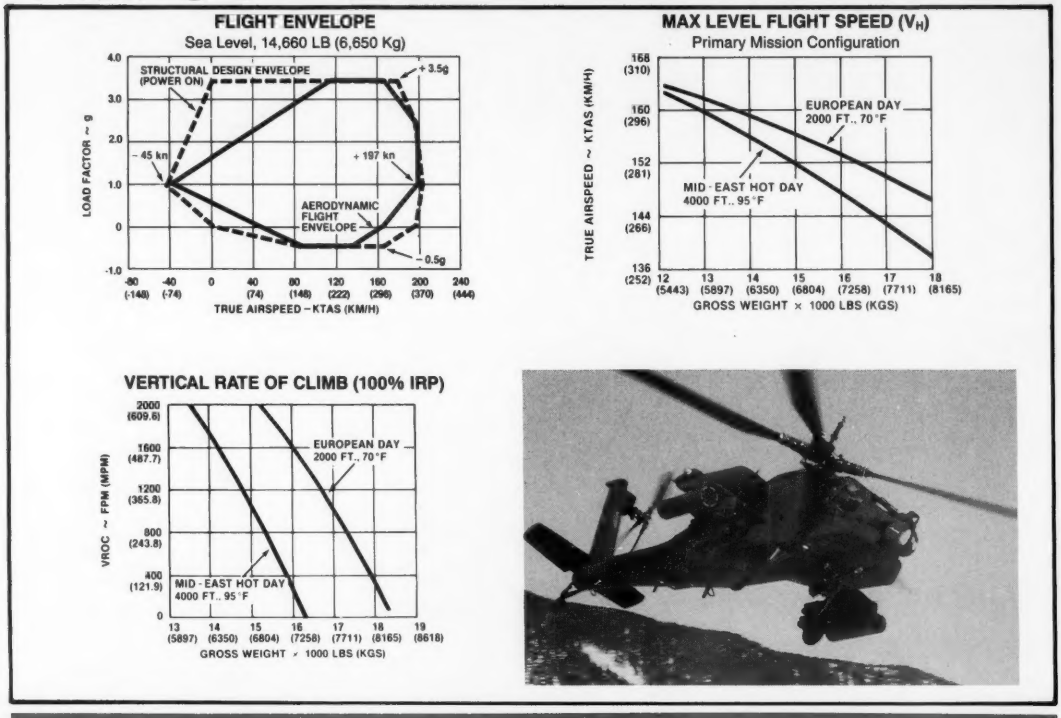
An added advantage for the combined arms team is the Apache's ability to penetrate enemy defenses along a controlled corridor and the means to neutralize strategic locations.

The AH-64 exploits the tactical advantages of terrain masking and nap-of-the-earth (NOE) flight particularly at night and during weather conditions that ground most helicopters. Its ability to designate targets and to use weapons that provide maximum standoff ranges make the Apache a superior tactical weapons system.

AH-64s can engage autonomously or work as a team member. As many as 10 target locations can be passed to the AH-64 and entered into its fire control computer. The computer can then pre-position weapon systems and display steering information, thus providing rapid target engagement. The AH-64 provides effective suppression of primary threat air defenses and enhances survivability of the combined arms team.

A twin-engine, four-bladed helicopter, the Apache is operated by a tandem-seated crew of two. It delivers unprecedented firepower quickly and accurately. The pilot is in the rear crewstation while the copilot/gunner (CPG) can concentrate on detecting, engaging and destroying enemy targets from the forward position. The array of weaponry includes: HELLFIRE missiles, aerial rockets and the McDonnell Douglas 30 mm chain gun area weapon system.

A pilot night vision sensor (PNVS) and a target acquisition and designation sight (TADS) enable the Apache crew to navigate and conduct precision attacks during day and night and under low visibility conditions.


FLIGHT ENVELOPE
Sea Level, 14,660 LB (6,650 Kg)
STRUCTURAL DESIGN ENVELOPE (POWER ON)
+3.5g
- 45 kn
+ 197 kn
AERODYNAMIC FLIGHT ENVELOPE
-0.5g
LOAD FACTOR ~ g
TRUE AIRSPEED – KTAS (KM/H)
MAX LEVEL FLIGHT SPEED (V_H)
Primary Mission Configuration
EUROPEAN DAY 2000 FT., 70 °F
MID - EAST HOT DAY 4000 FT., 95 °F
TRUE AIRSPEED ~ KTAS (KM/H)
GROSS WEIGHT × 1000 LBS (KGS)
VERTICAL RATE OF CLIMB (100% IRP)
EUROPEAN DAY 2000 FT., 70 °F
MID - EAST HOT DAY 4000 FT., 95 °F
VROC ~ FPM (MPM)
GROSS WEIGHT × 1000 LBS (KGS)

Flight Performance

The U.S. Army's primary mission for the AH-64 requires performance with a minimum vertical rate of climb of 450 feet per minute and a cruise speed of 145 knots while carrying 8 HELLFIRE missiles, 320 rounds of 30 mm ammunition and fuel for a 1.83-hour mission at the standard Army hot day of 4,000 feet, 95 degrees Fahrenheit. The AH-64 has demonstrated flight performance that meets or exceeds these demanding Army requirements. The Apache's demonstrated flight performance also significantly exceeds the capabilities of other Army attack helicopters.

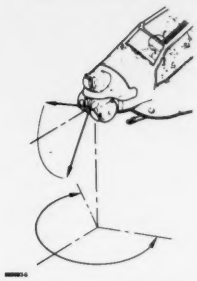
Some of the impressive AH-64 features are:

- Superior NOE capability.
- Low vibration.
- Maximum level flight speed of 164 knots.
- Sideward and rearward flight speeds of 45 knots.
- Sustained rates of climb in excess of 3,000 feet per minute.
- Maximum gross weights up to 21,000 pounds.
- High maneuverability from plus 3.5G to minus 0.5G.

The Apache is one of the smoothest flying helicopters ever built. Low vibration levels are the result of outstanding engineering development efforts and are attributable to the fully articulated four-bladed main rotor, the static mast, the "scissor" tail rotor and to a rugged airframe with tuned stiffness. Pilots may operate this attack helicopter throughout the flight envelope over extended time without themselves acquiring vibration-induced fatigue, thus maximizing the full potential of the aircraft.

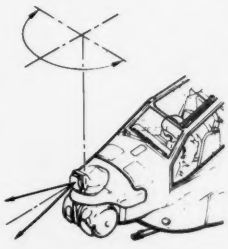
Enhanced NOE flight is provided by an exceptionally responsive rotor system with substantial control power margins. The AH-64 has a high degree of controllability, remarkable low-speed stability and excellent overall performance.

▼ TARGET ACQUISITION DESIGNATION SIGHT

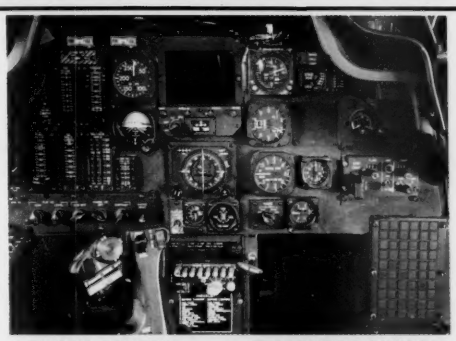


- STABILIZED SIGHT FOR DAY AND NIGHT TARGET ACQUISITION
- AZIMUTH ±120°
- ELEVATION + 30° TO –60°
- SLEW RATE 60°/SEC
- DAY SIDE
  - DIRECT VIEW OPTICS
  - DAY TV
  - LASER RANGEFINDER/DESIGNATOR
  - LASER SPOT TRACKER
  - AUTOMATIC TARGET TRACKING
- NIGHT SIDE
  - FLIR

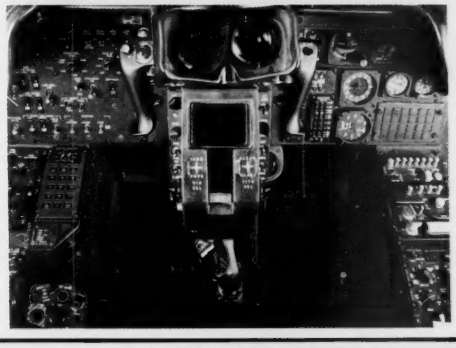
▼ PILOT NIGHT VISION SENSOR



- STABILIZED FORWARD LOOKING INFRARED (FLIR)
- AZIMUTH ±90°
- ELEVATION + 20° TO –45°
- SLEW RATE 120°/SEC
- FIELD OF VIEW
  - 50° DIAGONAL
  - 1 POWER
  - FAR INFRARED RANGE 8-14 MICRONS



▲ PILOT'S CONSOLE ▼ COPILOT'S CONSOLE



Visionics, Sensors and Avionics Systems

The Apache incorporates an integrated sensor system. Visionics provided by the TADS enable the CPG to accurately search, detect, recognize and engage targets at significant standoff ranges. The TADS combines:

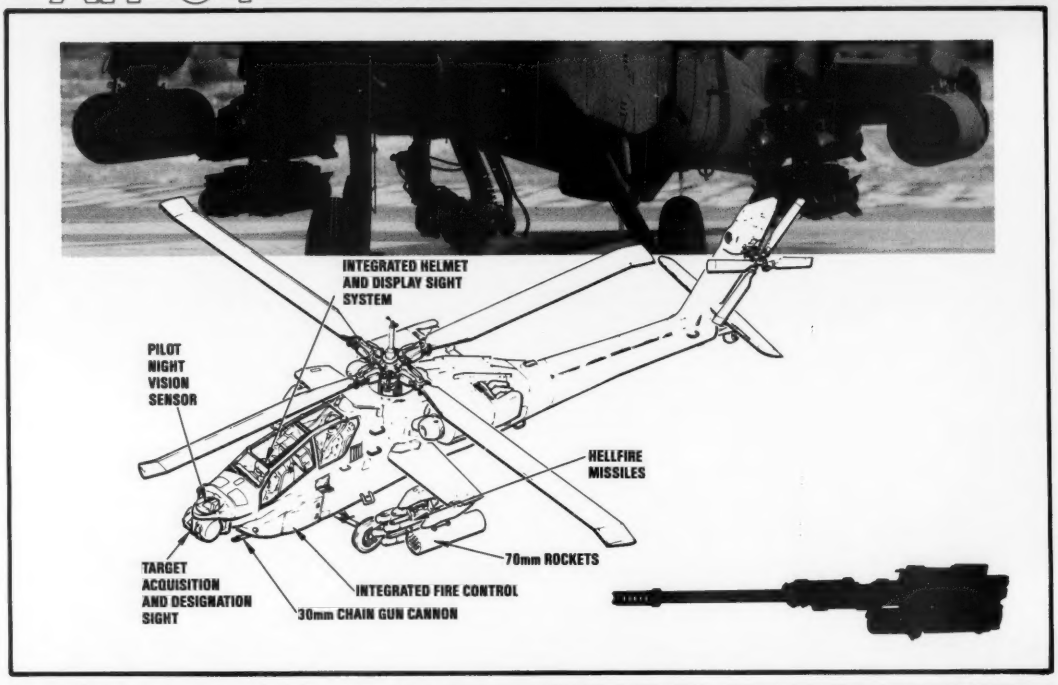
- High-power direct-view optics,
- A forward looking infrared (FLIR) sensor for night operations,
- A high-resolution television system for day operations,
- A laser target designator/rangefinder, and
- A laser spot tracker.

All of these are packaged within a compact, stabilized turret. Through the onboard fire control computer the TADS provides fire control data to all weapons systems.

The TADS is operated by the CPG, but its video may be used by either crewmember. The TADS wide-field-of-view FLIR also provides backup capability for the PNVS.

Through the Integrated Helmet and Display Sight System, the PNVS provides the pilot with real-time thermal imagery of the terrain, permitting combat operations in total darkness. Flight and weapon symbols are superimposed on the imagery provided to the crew on the helmet-mounted display. While the pilot is the primary operator of the PNVS, it also can be used by the copilot/gunner. TADS and PNVS are two separate systems individually controlled by the CPG and pilot.

An advanced lightweight avionics equipment package provides secure UHF-AM, VHF-AM and FM radio communications. The Lightweight Doppler Navigation System, with Heading Attitude Reference System, permits accurate nap-of-the-earth navigation and provides for storing waypoints or target locations. The avionics suite includes an automatic direction finder and a lightweight identification friend or foe transponder with a secure encoding feature.



Firepower

The Apache is a totally integrated weapon system. Firepower options include up to 16 HELLFIRE missiles, 76 70 mm aerial rockets and 1,200 rounds of 30 mm ammunition. Of these, the HELLFIRE laser-guided missile subsystem is the primary armament, capable of defeating armored vehicles. Use of HELLFIRE minimizes AH-64 engagement time and permits missile launching from concealed positions.

HELLFIRE is employed using direct or indirect firing modes with single-fire, rapid-fire and/or ripple-fire missile engagement. Normally, direct- and rapid-fire modes are fired autonomously by using the onboard laser to designate the target. Ripple- and indirect-fire modes are used in cooperative attacks with designation made by other attack helicopters, laser equipped scout aircraft, remotely piloted vehicles, or remote ground designators. The indirect mode allows the Apache to destroy threat armor while remaining masked at significant standoff ranges.

The 30 mm chain gun automatic cannon is the primary area weapon subsystem. It provides suppressive firepower and the capability to destroy lightly armored vehicles. This weapon system is normally operated by the CPG using the TADS. But, it may be directed by either crewmember using the helmet-mounted sight. The cannon uses a high explosive dual-purpose round, that has exceptional terminal effects. In addition, it is United States/North Atlantic Treaty Organization ammunition compatible.

Another firepower option consists of 70 mm folding fin aerial rockets (FFARs). New developments for the 70 mm FFAR—such as the Mark 66 motor, the multipurpose submunition warhead, and articulating pylons—have significantly enhanced the effectiveness of this system. The aerial rockets may be fired by either crewmember with aiming and steering commands shown on the helmet display. Aerial rockets can be employed in conjunction with the TADS for increased accuracy. The crew can select fuse ranges, heights of detonation, mode (singles, pairs or quads), launch rate, quantity launched and zones for launch.

All weapons systems are directed through a fire control computer that significantly raises target hit probability. By pre-pointing weapons and computing precise ballistic trajectories, the fire control computer reduces time to acquire targets. It provides the best weapons system performance ever achieved in an attack helicopter.

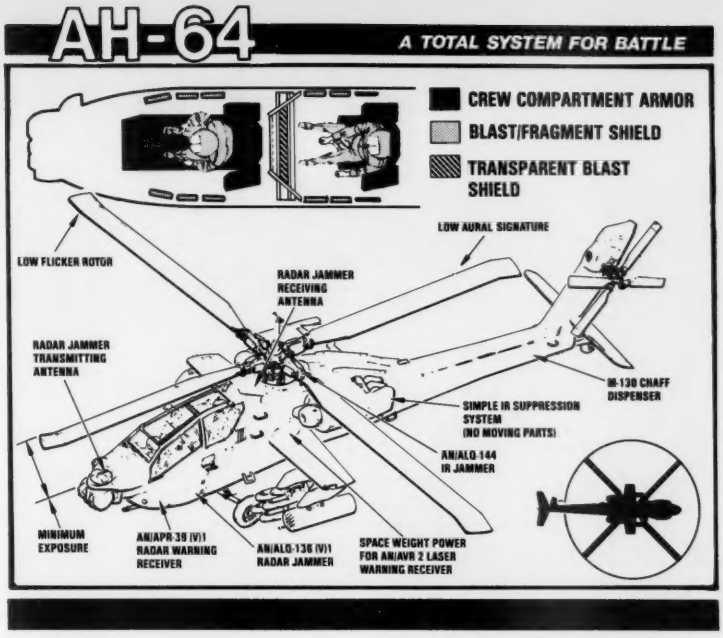
Combat Survivable

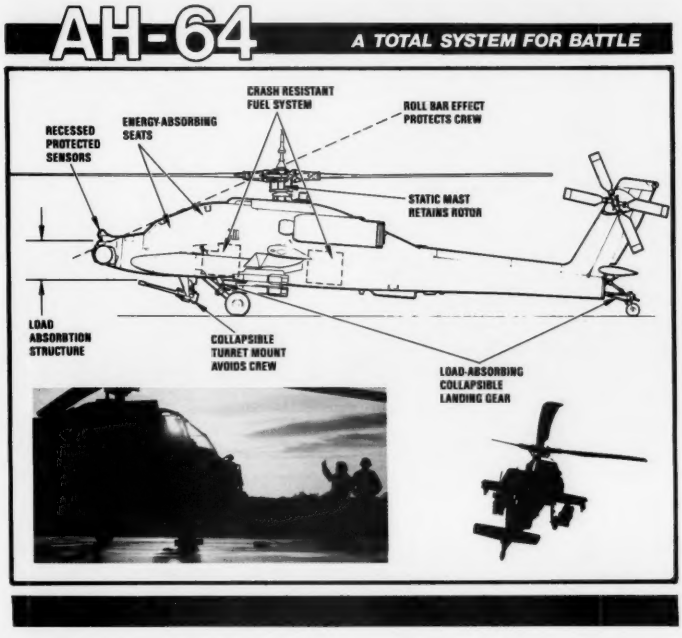
Battlefield survivability will be a challenge to all aircraft in the high threat environment. The AH-64 is the most survivable helicopter ever built. This was achieved through the use of advanced technology, high strength materials, optimized weapons lethality, maximum standoff ranges, and doctrine and tactics designed for the modern battlefield.

The AH-64 has very low detectability because of its reduced aural, visual, radar and infrared (IR) signature, low-flicker main and tail rotors, low-glint canopy, composite materials, compact design and IR suppression characteristics.

Aircraft survivability equipment (ASE) consists of a passive radar warning receiver, an IR jammer, a chaff dispenser and a radar jammer. The ASE enables the Apache to stand and fight while rendering threat systems ineffective.

Apache is ballistically tolerant as a result of its twin engines, redundant flight controls, armor protection, ballistically tolerant components, self-sealing fuel cells and a blast shield that separates the crew compartments. Also, the Apache is invulnerable to single small arms hits and is nearly invulnerable to 23 mm projectiles. For the majority of conditions, the capability exists to not only safely return to base, but to complete the entire mission before doing so.

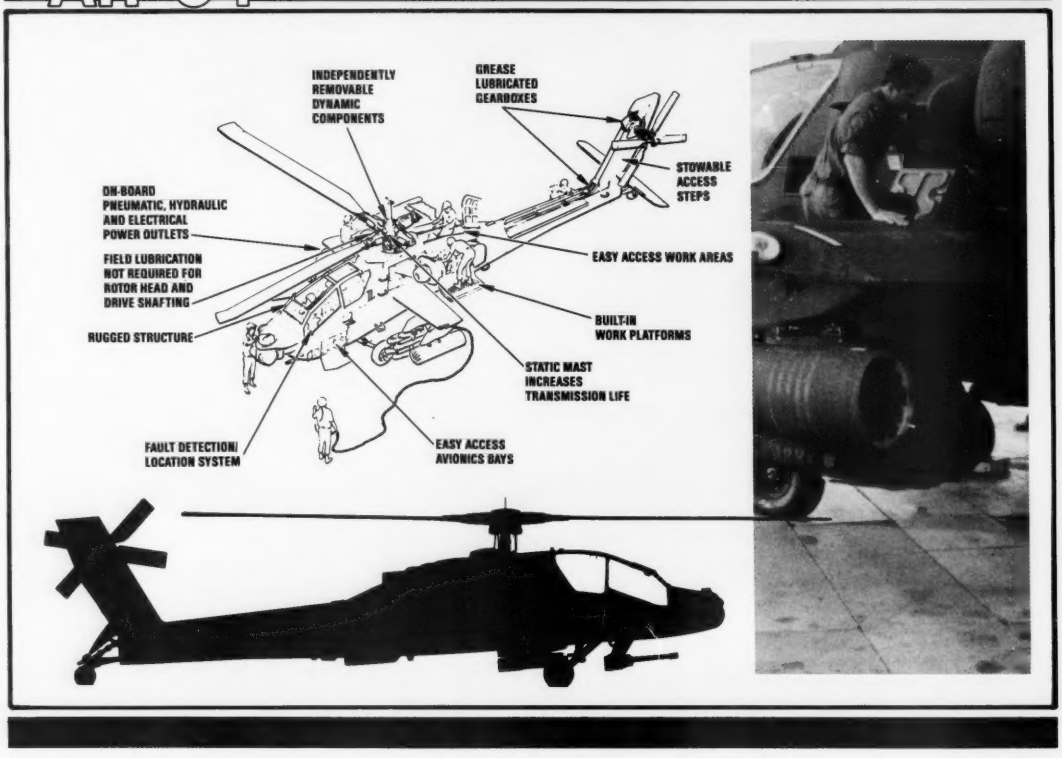




Crashworthiness

In the event of an accident, crashworthiness designed into the Apache protects both the crew and the aircraft. The crew can survive a 42-foot-per-second vertical crash impact. Rugged construction and innovative design contribute to the low attrition rate to assure that both crew and helicopter can reenter combat.

Tested and proven design features include high strength, armored and energy-absorbing crew seats; a redundantly supported static mast and main transmission; a crashworthy fuel system; and a trailing-arm, energy-absorbing main landing gear.


INDEPENDENTLY REMOVABLE DYNAMIC COMPONENTS
GREASE LUBRICATED GEARBOXES
STOWABLE ACCESS STEPS
ON-BOARD PNEUMATIC, HYDRAULIC AND ELECTRICAL POWER OUTLETS
FIELD LUBRICATION NOT REQUIRED FOR ROTOR HEAD AND DRIVE SHAFTING
EASY ACCESS WORK AREAS
RUGGED STRUCTURE
BUILT-IN WORK PLATFORMS
STATIC MAST INCREASES TRANSMISSION LIFE
FAULT DETECTION/ LOCATION SYSTEM
EASY ACCESS AVIONICS BAYS

Reliable—Available—Maintainable

The Apache is the most reliable and maintainable attack helicopter ever developed. Reliability has been a major objective in the design of the AH-64. As a result of that effort, the Apache has a greater than 95 percent probability of successfully completing assigned missions. High component reliability is reflected in the low maintenance requirements of the system. Despite the increased capability and number of systems onboard, maintenance requirements have been reduced to less than half those needed for earlier attack helicopters.

Maintainability in the combat environment also was considered during the design. The fixed-rotor mast design permits main transmission or drive shaft removal without affecting the main rotor installation. Built-in maintenance platforms, quick removal fairings and large removable panels provide access to components.

Maintenance requirements are further reduced by using grease-lubricated intermediate and tail rotor gearboxes, and elastomerics in the rotor head. Low mean-time-to-repair is supported by using the built-in fault detection locating system, which rapidly identifies and isolates problems to a line replaceable unit for replacement or repair.

The on-condition maintenance concept is used extensively throughout the AH-64. Parts are replaced only when condition or wear requires it. This provides full life use of components and eliminates unnecessary maintenance. The end result is greater aircraft availability at lower cost.

The Apache has a high degree of self-supportability. This is provided by rapid access to systems, functional equipment grouping and an onboard auxiliary power unit (APU) power source. The onboard APU provides power for engine starts and maintenance checks, thereby reducing ground support equipment requirements.

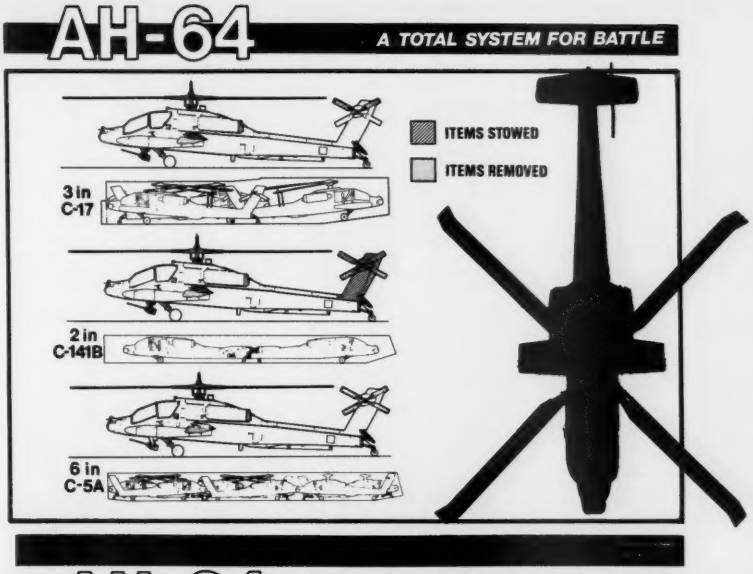
Air-Transportable

The AH-64 is capable of rapid strategic deployment worldwide; it is air-transportable in C-130, C-141, C-17 and C-5 aircraft. One Apache can be carried in a C-130, two in a C-141, three in a C-17 and six in a C-5. Air transport preparation time varies with the lift aircraft involved. Six Apaches may be prepared for C-5 transport in 3 hours. Upon arrival at the destination, preparation for flight is a simple reversal of the loading process.

Self-Deployable

Auxiliary fuel tanks provide self-deployment for the Apache with a 1,000 plus nautical mile ferry range and a 20-minute fuel reserve. Within a theater of operations, the Apache is easily deployable on internal fuel. Rapid deployment, whether by Air Force transport or self-deployment, makes the Apache an important element of United States' strategic forces worldwide.

As fielding progresses, the full impact of Apache as a combat multiplier will be realized. Its performance capabilities and ability to carry various combinations of ordnance will provide ground commanders 24-hour tactical flexibility, responsiveness and effective firepower where they choose to use it.



Previous AH-64 Apache Articles

- "Bell AAH YAH 63," Bell Helicopter Textron, May 1976.
- "Hughes AAH YAH-64," Hughes Aircraft Company, May 1976.
- "On the Attack Helicopter," BG Edward M. Browne, January 1979.
- "Keep the Apache Flying and Fighting," MAJ Troy J. Roop, March 1982.
- "AH-64 Apache Aviator Training," CPT Richard A. Scales, December 1983.
- "The AH-64 and OT II," CPT Robert L. Johnson Jr., January 1985.
- "AH-64 Update," CPT David W. Starr, March 1985.
- "AH-64 Apache," MG Charles F. Drenz, December 1985.
- "AH-64 Apache Combat Mission Simulator—Kill or be Killed":

"Part I: The Battleground," CW4 William Yarlett, March 1985.
"Part II: The Apache," CW4 William Yarlett, April 1985.
"Part III: The Tactical Algorithm," CW4 William Yarlett, May 1985.
"Part IV: Instructional Features," CW4 William Yarlett, August 1985.
"Part V: The Future," CW4 William Yarlett and Mr. Richard Oswald, September 1985.

ARMY AIRF

Along with the many changes brought about by Army Aviation becoming a member of the maneuver arms team, has come the need for Army air support facilities to also modernize their structures and to update their overall operational techniques. This article takes a look at what Desidero Army Airfield (A-511), Camp Humphreys, Korea, did to improve its facility and services to keep up with the changing times of Army Aviation.

Colonel Charles Woodhurst
Commander
Mr. George Dolak
ATC Specialist
U.S. Army Air Traffic Control Activity
Fort Huachuca, AZ

IN THE PAST 5 years, Army Aviation has become a key member of the combat arms and, importantly, of the maneuver arms with Infantry and Armor. Its accomplishments have been numerous and its development and growth are at the frontier of technology and tactical doctrine. Recognizing the new dimensions offered in support of combat operations, the Army is anxious to fully use the resources and capabilities of Army Aviation. The Eighth U.S. Army (EUSA) in Korea is among the leaders who are using Army Aviation to enhance combat operations. As a specific example, EUSA can proudly say it has one of the most modern and up-to-date Army airfields in existence.

The airfield upgrade project began as part of the EUSA fiscal year 1982 Military Construction, Army. In May 1981, EUSA informed the U.S. Army Air Traffic Control Activity (USAATCA) that a multimillion dollar upgrade of Desidero Army Airfield (A-511) at Camp Humphreys, Korea, was planned. This upgrade would accomplish extensive improvements to the airfield, to include air traffic control facilities and navigational aids.

The requirement and engineering surveys were accomplished in May 1981. The requirement survey was conducted by USAATCA and was used as a basis for the engineering of the various radios, communication consoles, recorders, telephones and navigational aids needed to support the mission of a fully operational, instrument flight rules airfield.

The first stage of the air traffic control (ATC) portion of the project started by tasking the U.S. Army Information System Management Agency (USAISMA) with the project management responsibility. USAISMA is the responsible agency for equipment acquisition, engineering support tasking and quality assurance. The en-

IELD A-511

gineering, installation and quality assurance for communications-electronics (CE) was tasked to U.S. Army Information Systems Engineering Support Activity. The responsibility for installation of all CE equipment was given to the U.S. Army CE Installation Battalion. The quality assurance was provided by the Test Evaluation Division. The Communications Engineering Directorate ensured that all the preliminary engineering effort supported the requirements.

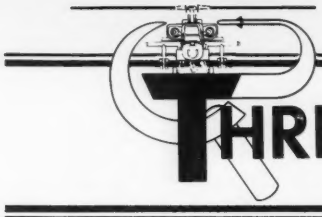
Many difficulties had to be resolved before the completion of the A-511 project upgrade. During the engineering survey, it was discovered that the communications feeder cable from the Camp Humphreys Dial Central Office did not contain sufficient cable pairs to support the operational requirements at the airfield. These requirements included a new ATC tower, base operations building, fixed base radar with radome, new key telephone system, nondirectional beacon and new weather facilities (engineered and installed by the U.S. Air Force). As a result of this support requirement, the feeder cable was replaced and a new cable distribution system was developed. This action not only provided the support necessary, but it also made provisions for expansion capability in future years.

Construction of the new operations and ATC tower building began in spring, 1982. The 802d Engineer Battalion was tasked with the grading of the airfield and a Korean contractor accomplished the construction of all major facilities. The construction phase was plagued with design deficiencies and natural disasters. During the joint Army-Air Force inspection in July 1984 numerous deficiencies were noted which delayed the installation of the new equipment. In September 1984, it was discovered that the floor of the base operations building had settled as much as 5 inches. Core samples indicated that the soil had not been compacted to standard. The interior of the building had to be removed and the floor excavated to a depth of 5 feet. Before the soil could be compacted, a water line broke due to cold weather and the building was flooded. The entire project was delayed for more than 18 months. Finally in May 1985 the building was accepted by the facilities engineers and a decision was made to start the installation phase.

The Bill of Materials had been pre-positioned at A-511. The installation of equipment started on 6 May 1985. Three teams were involved in what developed into a round-the-clock operation. All efforts were made to preclude further delays. Numerous problems were encountered with the installation of the radar equipment since the radar indicators were to be remoted from the receiver-transmitter radar group. But by November 1985 all the systems were operational and ready to be certified by the Federal Aviation Administration.

An instrument landing system is scheduled for installation at Desidero Army Airfield; it will give an added all-weather capability to the airfield. A-511 plays an important part in the defense of the country and all the improvements made have increased the capacity of the Eighth Army to meet the challenge and provide Army Aviation with needed support.

Desidero Army Airfield is the second busiest Army airfield outside the continental United States. A-511 plays an active role in maintaining stability and peace in Korea—the "Land of the Morning Calm."



Professor Vladimir P. Gorshenin
Russian and Area Studies
U.S. Army Russian Institute
APO New York

Kamikaz-Ski

or Russian Roulette in the Sky

Although not specifically discussing attitudes of Soviet helicopter pilots in air-to-air situations, the author, a professor of Russian and Area Studies at the U.S. Army Russian Institute, explores some recent occurrences that reveal how Soviet pilots are taught to react in aerial encounters. The article is "food for thought," and perhaps discussion and for further articles, which will uncover added worthwhile information about how Soviet helicopter pilots might react in various air-to-air encounters.

SOME TIME AGO now, world indignation was aroused at the shooting down of an unarmed Korean airliner by a Soviet fighter plane. In the unexcited manner one would normally associate with an everyday occurrence, the Soviet pilot cold-bloodedly killed 269 passengers, mindless of the presence among them of women and children. A storm of protest blew up around the world. A statement was demanded of the Union of Soviet Socialist Republics by people who saw in the Soviet action something apparently totally inexplicable. Finally, a detailed answer was given by Andrei Gromyko, a Politburo member and, then, Foreign Minister of that nation. For all to hear, he admitted, "We shot the plane down and would do so again." He also remarked, with some irritation, that the aircraft's destruction was no reason for the wave of anti-Soviet hysteria which had swept around the world. With these comments he sought to close the incident.

Some months later, an article entitled "The State's Vital Task" appeared in the Soviet journal *Aviation & Space*. Written by a General Golubev, representing

the Soviet General Staff, the article made several documentary assaults on the forces of the United States and its North Atlantic Treaty Organization allies. Discussing the Korean airliner tragedy, the bold general repeated the official Russian line, but also described some of the responsibilities of a pilot faced with such an interception. He explained that on approaching an aircraft breaching Soviet airspace, a pilot was required to make a positive identification of the intruder using all his onboard resources, and all the available information from ground-based controllers. If given the opportunity, the pilot should also attempt a visual examination of the stranger to establish the intruder's nature and origins. Thereafter, the pilot must act as he deems appropriate, decisively and unflinchingly, exhibiting courage, resourcefulness and tactical flair.

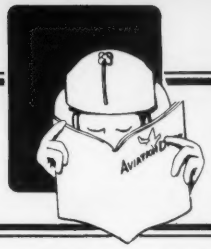
Reading the last phrase, you may ask yourself; how much of these qualities does it really take to shoot down an unarmed airliner? Does the launch of a guided missile against such a target really require courage and decisiveness, endurance and daring, the guts to make the supreme sacrifice if necessary to achieve the kill? From the Russian article it appears so! It's no accident that Golubev refers to a Captain Eliseev who, "Some years ago, pursuing an unidentified aircraft, engaged his afterburner and closing with the intruder rammed and destroyed it."

This reference matches a recurring theme of self-destructive heroism in some Soviet papers and periodicals. In December 1983, a lengthy article entitled "At the Limits of Interception" appeared in the Russian Army newspaper *Red Star*. The piece described the exploits of "a master of aerial interception" (a Major Kulyapin) who, learning from the "heroic examples" of the last war had investigated the feasibility of destroying aerial targets by ramming. The major described the technique as a "weapon of the brave." His description is backed up by Golubev's admission that, "Although our airmen carried out hundreds of rammings in the last war, not all had a happy outcome for the men involved." Indeed, this is a significant understatement! However, these unfortunate facts aside, both Golubev and Kulyapin draw the conclusion that ramming by today's jet aircraft could work. Although Kulyapin notes that, "For success, every action must be carefully thought out on the ground before any aerial engagements are attempted," his studious approach seems to conflict with that of Golubev who, drawing inspiration from Eliseev, seems to see the art as a final encounter for the aviator concerned.

Since Soviet airmen (even those described by Golubev as, ". . . filled with a boundless love for their motherland") are unlikely to rush to volunteer their services for ramming missions, perhaps the idea is without merit. (But it is such an "alluring concept," with such "marvelous possibilities," isn't it?) The *cost* in terms of international prestige for the Soviet Union over the Korean airliner incident has been enormous. The Soviet leadership was clearly less than impressed with the American release of a tape with the intercepting pilot's air-to-ground messages. Of course, there is no doubt in Soviet minds that the whole affair was vital to their national security. But how much better it would have been had the operation taken place in greater silence, electronically that is. Clearly, some proponents of ramming see it as offering the solution to a knotty problem. But, control conversations aside, would it not be easier, quicker and more effective to use conventional attack methods like cannon fire or a missile? The answer is of course—"yes," but these forms of attack reveal themselves clearly on modern military radar screens. Ramming achieves the desired kill while conferring a measure of security, and it makes it easier for the pilot to carry out that final, essential, visual identification.

Soviet airmen in training have traditionally sung a stirring little song that begins with the words "My uchim letat' samolety, my uchim ikh strakh pobezhdat'," which means "we're learning to fly, overcoming our fears." Perhaps new generations of kamikaz-ski pilots will change that to "we're learning to ram, we'll end up in tears"!

VIEWS FROM READERS



Editor:

I would like to obtain the following articles:

• "Field Artillery and Army Aviation," Major General John S. Crosby, chief, Field Artillery Branch, February 1985.

• "Attack Helicopter Operations on the Heavy Battlefield," Major General Frederic J. Brown, chief, Armor Branch, July 1985.

• "The Combat Aviation Brigade in the Light Infantry Division," Major General John William Foss, chief, Infantry Branch, August 1985.

These articles are listed in the September 1985 issue of the *Digest*, "The Challenge of Winning," on page 9.

Thank you for your assistance in obtaining these articles for my future reference.

LTC (P) Stanley F. Cherrie
Deputy Director
Division Operations Cmte
U.S. Army Command and
General Staff College

Editor:

I read with interest the comments of SGT Staples on page 45 of the September 1985 issue regarding underwater egress training.

I wholeheartedly agree with SGT Staples on one point. However, I do take issue with him on another. I take issue hesitantly as one of the first things the Navy teaches a junior officer is not to argue with knowledgeable NCOs!

SGT Staples is absolutely correct that underwater egress training should be repeated throughout an aviator's career. I was shocked to conclude that the Army might not require it. Further, the training is also important to those who typically ride in helicopters. Like Army troops, the Marines probably do not get as much training in this critical area as they should. It is an unfortunate statement on the impact of fiscal constraints.

However, having participated in Naval flight training, a la an "officer and gentleman" (a typical Hollywood distortion), including the full gamut of water training, I came away not with the conclusion that SGT Staples did. As those who have participated in the training know, the Navy uses generic trainers. They approximate an aircraft or a helicopter but no specific one.

I believe the reason for this generic approach is not to lull an aviator into thinking he can ever be complacent about safety, especially water egress. Perhaps my experience is typical—I panicked during my first run on "Dilbert Dunker." And as for those uninitiated, "Dilbert" is truly the invention of a demented mind. But during my first run I found myself in the water, out of air, flailing at my harness and totally out of ideas. Then I sensed a "ring" of coolness around each eye, deep in the socket.

It was water. I was in panic. My eyes were bulging out!

It didn't help me then. The divers had to pull me out. But I never forgot that feeling of panic or the debilitating effect it had. I learned that I had to first control myself before I could control anything else; in or out of the water. The water egress training gave me the *confidence I could survive a water landing*. It may sound awfully basic, but it's an important realization. The particulars of each aircraft, its exit locations for example, I note and memorize before engine start.

And whenever strapping in I remember, as if it had happened that very morning, the fatal results of succumbing to panic. In a water entry situation panic would be natural. As in many other areas, the Navy successfully instilled in me the need to do the unnatural.

LT D. J. Habeger
USNR-R
Portsmouth, RI

Editor:

The first reunion of the Army U-1A Otter/CV-2 Caribou Crew Association will be held in Columbus, GA, 15 to 17 August 1986. All former crewmembers and friends of these fine aircraft are invited to join the association and attend the reunion. For further information contact the association president, Sam Pinkston, 1145 Watson Drive, Columbus, GA 31907, TEL: 404-563-1264.

Bill C. Watson
Secretary
Otter/Caribou Crew Association

Editor:

The Society of the Republic of Vietnam (RVN) Airborne Division is planning the 2d Annual Red Hat Reunion at Ft. Bragg, NC, 15 to 17 August 1986. All former American and Vietnamese Red Hats and Red Markers who served with the RVN Airborne Division are invited.

Major events planned for the reunion include an airborne demonstration and static weapons display by the 82d Airborne Division and a capabilities demonstration by 1st Special Operations Command. Additionally, an old timers' jump is planned. The reunion will conclude with a banquet on 17 August at the Ft. Bragg Officers Club. A large number of former American advisors to the division and Vietnamese members of the division are expected to attend.

For specific details, contact either of us at (Kinzer): 9 Donelson Street, Ft. Bragg, NC 28307, telephone 919-497-6707; or (Baldwin): 737 Galloway Drive, Fayetteville, NC 28303, telephone 919-867-2674.

Colonel Joe Kinzer
Fort Bragg, NC
Colonel Dan Baldwin (Ret)
Fayetteville, NC

Editor:

On behalf of the members of the Aviation Division, Fourth United States Army, I would like to express my appreciation for the use of the [Army Aviation] Punchbowl Ceremony. Tailored for use during the retirement party of Colonel David E. Baeb, the Fourth Army Aviation officer, this presentation was most appropriate and proved to be both entertaining and informative.

This history of the birth and growth of the Army Aviation Branch serves as a tribute to those Army aviators who like Colonel Baeb entered the program in its infancy, nurtured it through its adolesence in Vietnam and helped to shape its character as the newest member of the combined arms team.

Thank you for a very enjoyable, nostalgic evening and for providing us the means to say farewell to a great soldier and fellow aviator.

LTC David J. Prentice
Chief, Aviation Division
Fourth United States Army
Ft. Sheridan, IL

• *Aviation Digest* will be happy to send an up-to-date script and slides that can be used at a dining-in or at other functions such as held by the Aviation Division, Fourth United States Army. For more information or to order, contact the *Aviation Digest* at the mailing address/telephone number furnished at the bottom of the contents page/inside front cover.

Maintenance Test Flight Evaluator Seminar

THE FIRST worldwide Maintenance Test Flight Evaluator (MTFE) Seminar was hosted by the United States Army Aviation Logistics School, Ft. Eustis, VA, from 21 through 25 April 1986. Representatives from every major Army command, including Europe, Hawaii, Panama, Korea and Alaska attended.

Mr. Joseph P. Cribbins, special assistant to the Deputy Chief of Staff for Logistics—while addressing the attendees—emphasized the role of Army Aviation logisticians in support of the Army's Aviation modernization program.

Major General Ellis D. Parker, Army Aviation Branch chief and commander of the Aviation Center, Ft. Rucker, AL, also addressed the maintenance test pilots and Army Aviation logisticians. He described the blueprint for Army Aviation in the future as being technology and stressed the importance of innovation, professionalism and aviation safety.

During the seminar, maintenance test flight evaluators and instructors attended management workshops and received formal training concerning the Army Aviation standardization program. This training, emphasizing the important roles of evaluators and instructors in the Army Aviation program, was presented by the Army Aviation Logistics School's Directorate of Evaluation and Standardization.

Two days were dedicated to systems training. Simultaneous training was conducted by maintenance test flight instructor pilots in several track groups. Aircraft training included the UH-1 Huey, OH-58 Kiowa, AH-1 Cobra, UH-60 Black Hawk, CH-47 Chinook, OV/RV-1 Mohawk, C-12 Huron and U-21 Ute.

The seminar was closed with aircraft systems and equipment updates presented by various U.S. Army Aviation Systems Command project managers' offices, private industry representatives and Army Aviation Logistics School directors.

The register for the 101 attendees reflects an average of 16 years of maintenance test flight experience and 4,000 hours in various type aircraft. This first worldwide MTFE Seminar provided the maintenance test flight evaluators with the most up-to-date information available concerning test flight manuals, test flight procedures, the aircraft they operate and the flight standardization program designed to assist commanders at all levels to improve unit readiness, aviation safety and professionalism through the use of standardized procedures and techniques.

The Aviation Digest *thanks CW4 Robert C. Cushman of the Army Aviation Logistics School for this report. Watch for a future article in which CW4 Cushman will provide more indepth coverage of this important first seminar.*

CW4 Robert C. Cushman

*Articles from the **Aviation Digest** requested in these letters have been mailed. Readers can obtain copies of material printed in any issue by writing to: Editor, **U.S. Army Aviation Digest**, P.O. Box 699, Ft. Rucker, AL 36362-5000.*

Part III

Against All Odds

Theoretical Aspects of Microburst Flight

By LCDR Joseph F. Towers

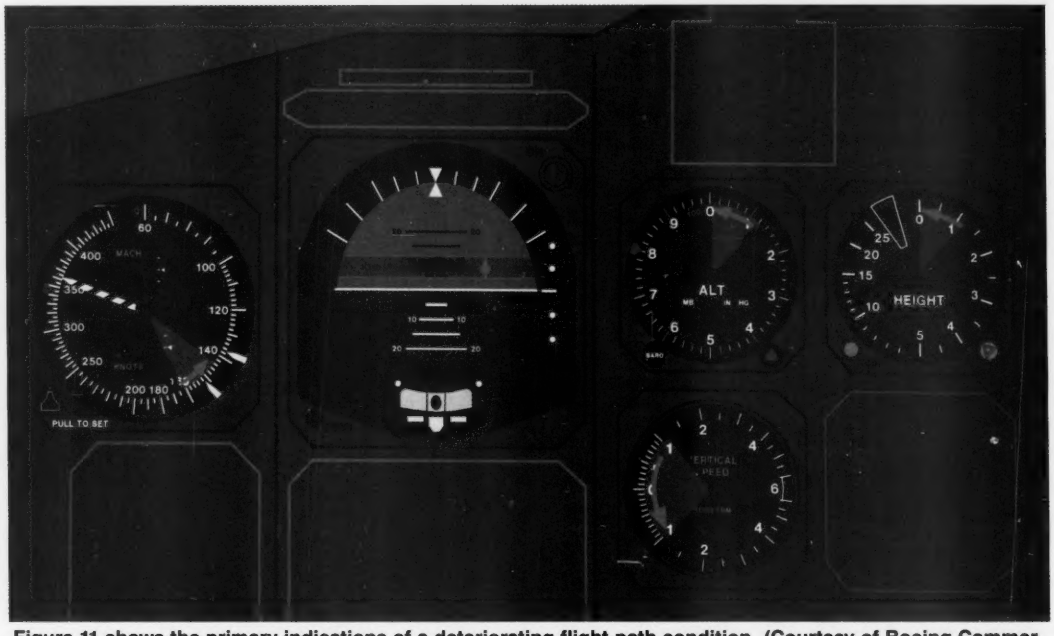


Figure 11 shows the primary indications of a deteriorating flight-path condition. (Courtesy of Boeing Commercial Airplane Company.)

About the Author

LCDR Joseph F. Towers is a reserve Naval aviator flying as an instructor pilot in the DC-9 with VR-57 at NAS North Island, CA. Commander Towers is a San Diego-based First Officer on the B-767 with American Airlines and an independent safety consultant specializing in microburst-induced windshear, flight crew training, and mishap prevention. Commander Towers has studied and written extensively on the phenomenon of microburst-induced windshear for the last 5 years. His most recent effort was compilation of an in-depth paper on the flight-related aspects of the microburst phenomenon. He presented this paper at the 24th Aerospace Sciences Meeting sponsored by the American Institute of Aeronautics and Astronautics in Reno, Nevada, in January 1986.

Commander Towers' article is being presented in three parts. Part I, in the May issue of ***Aviation Digest***, provided information to enhance flight crew understanding and increased awareness of the microburst threat.

Part II, in the June issue, presented a fundamental aerodynamic explanation of microbursts. Part III concludes Commander Towers' article. It provides some techniques to control flightpath direction during extreme microburst conditions.

While Army aviators are warned to avoid flying in weather where a microburst encounter is likely to occur, inadvertent encounters have been reported. This article has been presented to inform Army aircrews about microbursts, their effects on aircraft, and to provide information to increase chances of survival if an encounter with this deadly weather phenomenon does occur. In addition, the importance of timely and accurate reporting of microburst and windshear encounters by all pilots cannot be stressed enough. A pilot report of a fast-forming, fast-dissipating microburst may be the only warning another aircrew will receive.

Controlling Flight Path Direction

Non-angle-of-attack type aircraft

Now, let's envision a representative microburst encounter during takeoff and how it might appear in the cockpit of a non-angle-of-attack aircraft. Indicated airspeed may start to fluctuate erratically followed by a rapid increase as the frontal outflow winds are penetrated. Initial aircraft performance will improve substantially. Upon penetrating the downdraft, indicated airspeed decays rapidly followed by a decreasing vertical speed trend on the vertical speed indicator (VSI), altimeter and radar altimeter and a reduction in pitch attitude.

WARNING

Do not reduce pitch attitude in an attempt to recover indicated airspeed since this can result in a further reduction in angle-of-attack, a high rate of descent, altitude loss and even possible impact. Instead, use all available excess thrust to accelerate the aircraft. Remember that flight-path control is crucial and that airspeed, provided it is above stall speed, should be a secondary consideration.

WARNING

The pitch-down tendency of the aircraft, if not immediately countered by the flight crew, can lead to a rapid degradation of the vertical flight path and possible impact.

SHOULD A SUSPECTED SEVERE MICROBURST BE ENCOUNTERED:

- **ROTATE TO TAKEOFF ATTITUDE,** and simultaneously
- **ADVANCE THE THRUST LEVERS TO THE MECHANICAL STOPS REGARDLESS OF ENGINE LIMITATIONS.**

Pitch attitude should be increased to attain a greater angle-of-attack and lift coefficient. Rotation, even with indicated airspeed below normal, is a **counter-intuitive** yet crucial flight crew response. Primary concentration should be devoted to a positive, climbout pitch attitude.

Be aware that substantially greater control column forces will be required as the aircraft becomes more out of trim. Twenty to 30 pounds of back pressure, roughly equivalent to initial rotation, is common and should be expected.

NOTE: Some aircraft may have reduced elevator authority depending on stabilizer trim, airloads and degree of airspeed decay. This condition could prevent or inhibit rotation until the horizontal stabilizer is retrimmed.

If a descent rate exists below 500 feet, SMOOTHLY INCREASE PITCH ATTITUDE TO ATTAIN A POSITIVE CLIMB RATE.

If necessary, use **intermittent stick shaker** as the upper pitch attitude limit. Remember, this is a recovery technique to be used in an extremely critical situation to achieve a kinetic energy exchange for a short-term performance gain to reduce the probability of ground impact.

This technique applies to non-angle-of-attack aircraft during both takeoff and go-around and is given with this warning:

WARNING

Stall warning systems are not precise flight instruments. Unnecessary over-rotation to stick shaker can place the aircraft dangerously and prematurely close to stall. Rotate only enough to establish a positive climb. Continued rotation to stick shaker should only be attempted if ground impact appears inevitable.

CAUTION

Do not rely on aerodynamic buffet as a pre-stall warning since it may be masked if any turbulence is present.

WARNING

When verifying a positive climb rate on the vertical speed indicator, be aware that this pressure instrument may be erroneous because of variations in atmospheric pressure within the microburst. ALWAYS CROSS-REFERENCE THE RADAR ALTIMETER.

Glossary

fpm	**feet per minute**
KIAS	**knots indicated airspeed**
km	**kilometer**
JAWS	**Joint Airport Weather Studies**
VSI	**vertical speed indicator**
HUDS	**Heads-Up Display**
AOA	**angle-of-attack**

WARNING

Autopilot engagements in pitch modes should not be selected since attitude will be adjusted to achieve command airspeed selection.

CAUTION

If your aircraft has a flight director, disregard pitch command inputs since the "V" bars will command pitch attitude reductions during low-speed maneuvering to attain V(ref) or V_2 and can artificially inhibit deck angles when a higher pitch attitude may be required.

NOTE: Fast/slow speed indexes available on some flight directors should not be referenced during this flight regime.

The technique recommended for non-angle-of-attack aircraft is a crude attempt to optimize flight-path direction for an aircraft that is not properly instrumented for this condition. All future generation transport aircraft should use angle-of-attack indicators and advanced heads-up-displays (HUDS) with velocity vectors indicating flight-path direction, pitch guidance, and pitch limit indicators.

There should exist unanimous agreement that the indiscriminate chasing of indicated airspeed, without cross-reference to other instrumentation can, in itself, kill. During the highly dynamic conditions of microburst flight, airspeed is an inferior and invalid parameter for adequately deciphering the entire aerodynamic picture.

Angle-of-attack type aircraft

Now, let's take a look at an angle-of-attack aircraft during the approach.

As the outflow is penetrated, warning signs may include an erratic or increasing angle-of-attack, a rapid climb in indicated airspeed, a reduction in descent rate and a ballooning float to above the glideslope. The reduction of thrust and pitch attitude to correct back to the glideslope is a typical but deadly mistake. **Expect trouble in this situation and immediately execute a go-around. SHOULD A SUSPECTED SEVERE MICROBURST BE ENCOUNTERED:**

- **ROTATE TO GO-AROUND ATTITUDE, and simultaneously**
- **APPLY MAXIMUM THRUST, INCLUDING THE SELECTION OF AFTERBURNER.**

If a descent rate exists below 500 feet:

- **CONTINUE ROTATION, REFERENCING ANGLE-OF-ATTACK, TO ATTAIN A POSITIVE CLIMB RATE.**

CAUTION

Use OPTIMUM AOA as the upper pitch attitude limit. Expect an erratic and possibly unusable angle-of-attack.

NOTE: Aircraft having an advanced HUD should reference their velocity vector for flight-path direction.

This recovery maneuver applies to angle-of-attack-equipped aircraft during both the approach and takeoff.

In this highly dynamic encounter, expect continuously changing deck angles greater than those required during normal takeoff and go-around.

NOTE: In visual meteorological conditions, the loss of forward ground visibility may occur at deck angles above 15 degrees.

If a positive climb rate cannot be initially achieved or sustained, attempt to fly out in no less than a level-flight condition. Once downward acceleration has developed, an aggressive and extraordinary force is required to overcome it, one which may be nearly impossible for any energy-deficient aircraft to generate, especially when given very limited time and altitude constraints.

WARNING

There exists no guarantee of success with the techniques recommended herein since the physical forces of the given shear or microburst may easily exceed the aerodynamic capability of any given aircraft. These techniques are designed to optimize flight-path direction, utilizing existing instrumentation, during a critical phase of flight when ground impact is a distinct probability. Always delay the takeoff or approach if any reason exists that a potentially dangerous condition may be present.

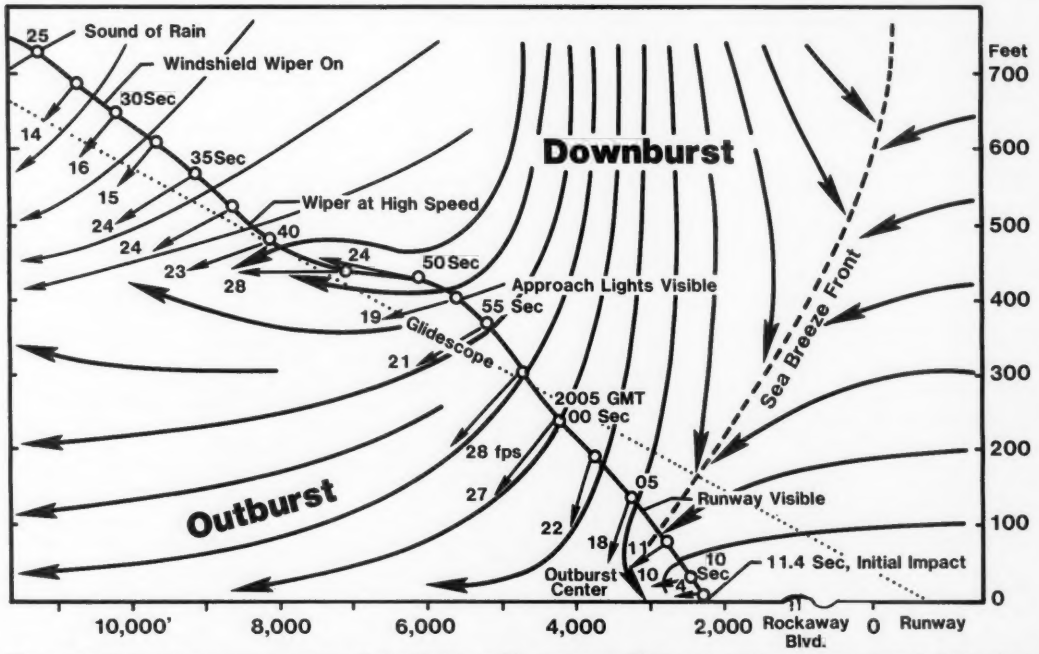
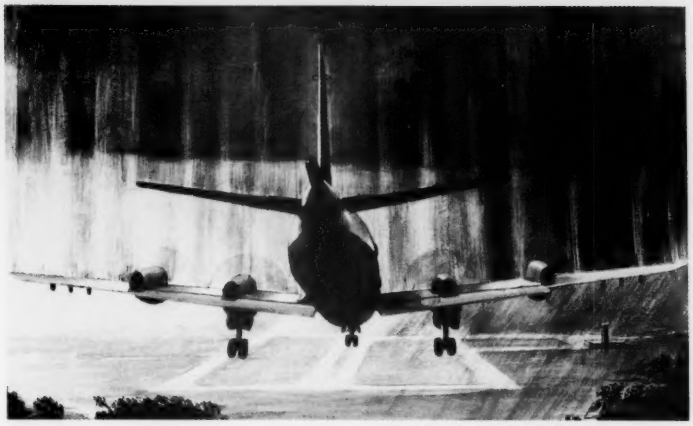


Figure 12 shows the reconstruction of the flight profile and prevailing gust patterns that existed at the time of the Eastern Airlines Flight 66 accident at John F. Kennedy International Airport in June 1975. Unfamiliarity with this unusual phenomenon and "normal pilot responses" contributed to this catastrophe. During this time, a sea breeze camouflaged the localized event while 15 knots of wind existed at the field. (Illustration courtesy of Dr. Fujita.)



Depiction of aircraft in extremis from a microburst encounter. Such a situation demands immediate and aggressive flight crew responses to redirect the aircraft's flight path to avoid impact. (Courtesy Blake Rader, U.S. Navy *Approach*, September 1982.)

CAUTION

Instrument meteorological conditions may be encountered with moderate to severe turbulence.

WARNING

During approach, do not engage autothrottles since they may reduce thrust too much when airspeed increases and, conversely, may not apply thrust rapidly enough when airspeed decreases.

For all aircraft, an impending recovery should be indicated by increasing trends in the following flight instruments: vertical speed indicator, radar altimeter, altimeter and indicated airspeed. This condition equates to an increasing performance profile that should be anticipated if the microburst is exited.

Faster approach and departure speeds provide additional performance potential for coping with a microburst encounter, but they do not in themselves guarantee a successful negotiation. Coordinated execution of pitch attitude and thrust management to control flight-path direction are far more important.

Remember that since power plus attitude equals performance, it is crucial to rotate while simultaneously applying maximum thrust. This recovery maneuver is the most expeditious means to compensate for loss of lift and to establish a new flight-path direction to prevent impact.

The problem with microburst conditions is that because the relative wind is changing so dramatically in both velocity and direction, it may easily exceed the pilot's or aircraft's ability to safely negotiate it! The aircraft may not be able to accelerate proportionately to compensate for the rate of change of the relative wind.

The microburst is a powerful atmospheric disturbance which poses an indisputable danger for all aircraft. During your flying career, you may encounter one or more microbursts. The outcome will depend on the intensity of the microburst, your aircraft's vulnerability at the time of the encounter and **YOUR ABILITY TO CONTROL FLIGHT-PATH DIRECTION. And you may have less than 5 to 10 seconds to recognize the situation and respond accordingly!**

Any way you play this game, remember—it's a stacked deck . . . one played against all odds!

ACKNOWLEDGEMENTS

The author extends his sincere appreciation to the following individuals for their assistance in developing helpful insights into this complex problem: Dr. T. Fujita (University of Chicago), Dr. J. McCarthy (National Center for Atmospheric Research), Dr. F. Caracena (National Oceanic and Atmospheric Administration), Dr. W. Frost (University of Tennessee Space Institute), Dr. R. Bowles (NASA Langley Research Center), Captain W. Melvin (Airline Pilots Association), J. Luers (University of Dayton Research Institute), K. Elmore (NCAR), Dick Bray (NASA Ames) and J.T. Lee (National Severe Storms Laboratory). The author has also benefited tremendously from discussions with hundreds of military and civil aviators, the participants at the 7th and 8th Annual Workshops on Meteorological and Environmental Inputs to Aviation Systems (University of Tennessee Space Institute, 1983 and 1985), Wind Shear/Turbulence Inputs to Flight Simulation and Systems Certification Workshops (NASA Langley Research Center, 1984) and the 24th Aerospace Sciences Meeting (Reno, Nevada, January 1986).

Special appreciation is given to Dennis Camp (FWG Associates), Dr. George Clarke (Naval Air Test Center), John B. Galipault (The Aviation Safety Institute), Dave Gwinn (Radar and Windshear Seminars), CDR Skip Leonard USN, Jim Luers (UDRI), LCDR Gray Morrison (Naval Air Test Center), Professor John H. Minan (University of San Diego), L. H. Mouden, J. H. Enders, E. Wood (Flight Safety Foundation), Captain Bert Smith (American Airlines), Jack Torres and Deborah Towers for their helpful comments regarding an earlier version of this article presented at the 24th Aerospace Sciences Meeting.

Professional credit is extended to ***Fasotragrupac*** Media Services, the Pacific Fleet Audiovisual Center at NAS Miramar and the U.S. Navy's ***Approach*** for their technical assistance in the development of certain illustrations, artwork and photographs over the past years.

PEARL'S

Personal Equipment And Rescue/survival Lowdown

PEARL, Dawna Salazar, uses the MQ-1A, a preflight tester of the oxygen mask, to detect leakage and malfunctions. It duplicates the oxygen, flash goggles and communications systems installed on aircraft. The tester performs "talkout" checks of helmets, headsets and mask microphones, and it provides regulated power for the EEU-2P flash protection goggles.

Establishment of an ALSE Shop

There are basic requirements for an ALSE support activity and they should be tailored to the needs of the aviation units concerned. Size of the room needed can vary, depending upon space available, number of aviators serviced and equipment to be maintained; but none should be less than 1,000 square feet (AR 95-17, appendix c, provides a good point of reference). ALSE shops should be separate and apart from other shops especially where oxygen requirements are concerned. The shop must be environmentally controlled (air conditioned) and:

- Be easily kept clean.
- Have ample room for workbenches, a desk, parts and equipment cabinets and racks for helmets and oxygen masks.
- Must have sufficient light.
- Have an air pressure source and enough electrical outlets.
- Contain adequate lavatory facilities with hot and cold water.

The oxygen equipment shop must meet the requirements of TM 55-1660-245-13.

Test/Inspection Equipment: Battery testers, radio set testers, strobe light test equipment, vacuum cleaner, oil and water separator for compressed air, manometer or pressure gauge, scale dial and beam, refrigerator (for battery storage), sewing machine (medium duty), assorted tools as needed, small soldering iron, torque wrench, screw drivers, pliers and vice grips. These tools and equipment can service many items of ALSE and survival gear, to include helmets, vests, LPUs, over-water, hot weather/cold weather survival kits.

Personnel Requirements: Must be ALSE qualified and trained in U.S. Air Force, Navy or U.S. Army or be approved by the U.S. Army ALSE training manager. Number of personnel required will depend upon number of aviators serviced and types and number of equipment serviced. Oxygen equipment technicians should be school trained in oxygen equipment/systems and servicing.

Crewmember Lockers: There must be room for storage of helmet, LPU, survival vest, helmet bag and/or survival kits in each locker. Equipment must be available for the ALSE technician to inspect and service. Lockers should be kept locked but accessible; they can be located in or near the operations office, in the ALSE shop or be adjacent thereto. Records must be maintained on all ALSE. Pyrotechnics should be stored in accordance with post policy. Signal kits/flares must be stored in accordance with post policy.

If you have a question about personal equipment or rescue/survival gear, write PEARL, AMC Project Officer, ATTN: AMCPO-ALSE, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798 or call AUTOVON 693-3817 or Commercial 314-263-3817.

AVIATION PERSONNEL NOTES

Enlisted Standby Advisory Board

Your commander has just informed you that you were not selected for promotion to sergeant first class. Once you have recovered from the initial shock, you begin to ask why, what happened?

You have always sought out jobs with increasing responsibility. Your enlisted evaluation reports (EERs) reflect a consistent pattern of outstanding performance. So what happened?

You begin with a visit to your military personnel office (MILPO). A review of your records and several inquiries by MILPO personnel reveal a number of significant errors in your record that was reviewed by the promotion selection board. What now?

Selection for promotion is an area that can be severely affected by errors or mistakes. To remedy this situation and to ensure that all noncommissioned officers (NCOs) are treated equally and not penalized by their errors, or by errors in the maintenance of their files, the Army conducts enlisted standby advisory boards (STABs).

Separate STABs are convened at the Military Personnel Center's (MILPERCEN's) Enlisted Records and Evaluation Center (EREC) at Ft. Benjamin Harrison, IN. The board members consider soldiers whose files did not appear before a recent selection board due to administrative error; were found to contain documents that should not have been seen by the board; included someone else's documents; or had missing documents.

These boards are scheduled about 6 months after the annual selection board for a given grade. The STAB for selection to master sergeant and sergeant major is combined due to the low number of records appearing before the board. It normally is scheduled to convene each year in February. The sergeant first class STAB is scheduled each year in June.

In addition to these two boards, other STABs are held throughout the year in conjunction with the regular promotion boards. Those boards consider NCOs for promotion to sergeant first class, master sergeant and sergeant major, and are held in October, March and July.

Criteria For Consideration—Before an NCO can be considered for a STAB, certain criteria must be met and specific procedures followed. Paragraph 7-44 of AR 600-200 provides the specific criteria concerning eligibility for consideration. The first category considered for STAB is composed of those files that were within the established zone of a previous selection board but were not considered. This can be for either the primary or secondary zone and is the only time NCOs in the secondary zone are eligible for STAB.

The second category is those files submitted for reconsideration. Only files from a primary zone are eligible. This category is composed of those files that had major errors in the record that appeared before a promotion board.

The determination of whether a file contains material errors will be made at MILPERCEN. Errors are considered material when a reasonable chance exists that had the error not existed, the soldier might have been selected for promotion.

Application For STAB Consideration—Any request for records to appear before a standby advisory board must be submitted through the NCO's chain of command to the servicing MILPO for evaluation to ensure that it meets the criteria outlined in AR 600-200. The case is then forwarded by the MILPO to MILPERCEN (DAPC-MSP-E), Alexandria, VA 22332-0400.

Once MILPERCEN determines that the case warrants STAB consideration, it is forwarded to the DA Secretariat for Enlisted Promotion Boards at EREC where the STAB is convened. Each STAB must have at least four members plus a board president, who also will be a voting member. Each soldier's file will be voted on by three members.

The file is reviewed against the comparison files in one of three ways, depending on the year of the board for which the soldier is being considered.

For calendar year 1979 and earlier, STAB members review the file being considered to determine if the soldier is fully qualified for promotion. The file is then compared to three files from the same career management field (CMF)—one high select, one low select and one nonselect—to determine the quality of the soldier's file. The board members vote the record with a yes or no, with the majority determining selection or nonselection for promotion.

In those cases being considered for a board that was held in 1980 or 1981, the file is compared to 10 files from the same CMF. These files are the last five selected for promotion and the first five nonselects. In this instance, the board members do not know which file is the actual file being considered for promotion. All files are voted using a numeric system, one being the low and six being the high.

If the actual file under consideration is voted as equal to or higher than the highest selected comparison file, the soldier is recommended for promotion. If it is lower than the lowest selected comparison, the soldier is not recommended for promotion.

If the file falls between the highest and lowest selected comparison files, the board will create an order of merit list (OML) and determine a select/nonselect cut point on the OML. If the case under consideration is above the line, then it will be considered a select. If below that line, it will be considered a nonselect.

Once all voting is completed, select/nonselect rosters are prepared and forwarded to the Deputy Chief of Staff for Personnel at DA, for approval. Each select/nonselect is sent a letter through the commander informing the NCO of the board results.

ULTRALIGHTS
Thrill or Threat

This article was adapted from an article written by Lieutenant Commander Caswell, U.S. Navy, and published in the April 1986 issue of *Approach*.

Aircraft: "Army tower, this is Army 336, left downwind for two four."

Tower: "336, report left base, runway two four, with gear."

Pilot: "Gear down, landing checklist."

Copilot: "Traffic 12 o'clock! Hard right! Hard right!"

Pilot: "Are we clear?"

Copilot: "Did we hit him?"

Pilot: "I don't know. It was real close—I didn't feel anything. Can you see it off to the right?"

Copilot: "Nothing airborne. Yes, I do. It's—It's an ultralight. He's just motoring toward the river."

Pilot: "Can you get his number?"

Copilot: "I don't see one. It's just a red and blue ultralight."

Pilot: "Tower, this is 336. We'd like to reenter a left base for runway two four. We had to deviate for an ultralight at about our one-thirty position."

Tower: "336, we are not aware of any traffic in the area. Did you get his number?"

Pilot: "Negative."

So ends an increasingly common story of one of the most recent hazards to military aviation, the ultralight aircraft. By themselves, these frail aircraft do not represent any unique danger, but when mixed with other aircraft, serious safety problems arise. The first reported deaths due to an ultralight colliding with a conventional aircraft occurred in the summer of 1985. A corporate jet on final hit an ultralight, killing the jet's copilot and the ultralight's pilot. Five others were seriously injured. According to the airport operator, the ultralight did not have radio contact with the airport.

There are several factors that go into making the ultralight a special kind of problem for the air traffic control (ATC) system. The first is the manufacturing guidelines contained in the Federal Air Regulations. Some guidance is given, but little is mentioned with regard to equipping the ultralight for operation within the ATC system. Ultralights frequently operate without a radio, altimeter or even an airspeed indicator. The dealers advertise that no special training or skills are required to fly an ultralight, and they emphasize that the aircraft is simply built.

This leads to the second and perhaps most important factor; the skill level of the pilot. A large number of pilots flying ultralights are not licensed, and one is not required. They often have little training in airspace restrictions, navigation or communications, and they don't realize the threat they may present to conventional airplanes or helicopters.

The last and most insidious factor is that ultralights are small, hard to see and don't show up on radar. These phantoms, operating outside the ATC system, show up unannounced, sometimes too late to avoid.

Some things that can be done to begin solving the problem are:

- Emphasize the old faithful method of *see and avoid*.
- Airfields should *publish NOTAMs* (notices to airmen) *for ultralight fields* in the vicinity. This information will alert pilots to use extreme caution when operating into and out of an airport with ultralights nearby.
- Aviation units should *maintain an aggressive reporting program*. Even though the ultralight pilot may be unlicensed and difficult to contact, report each encounter and include a detailed description of the ultralight.
- *Work with local ultralight groups and establish liaison with local dealers and airfields.* This requires effort, but a little education can go a long way in solving the problem.

When ultralights are flown away from airports that serve conventional airplanes and helicopters they pose no threat to others and provide the thrill of flight to many who otherwise would not fly. However, when ultralights become a safety hazard, as they can, the problem must be addressed directly through vigilant, aggressive reporting, communication and education.

The Federal Aviation Administration has developed air traffic control policy for the handling of ultralight *vehicles* (in the future they will be referred to as aircraft); also, directives have been proposed to further regulate the operation of ultralights.

Questions, comments or responses regarding ultralights should be directed to Mr. Lingiam Odems, AUTOVON 284-7796/6304.

Readers are encouraged to address matters concerning air traffic control to: Director, USAATCA Aeronautical Services Office, Cameron Station, Alexandria, VA 22304-5050.

AVIATION LOGISTICS

How Much Do You Know About Your Back-up dc Electrical Source?

Although the possibility of thermal runaway has been lessened by the use of plastic film separators in many Army Nicad batteries, electrical failures still occur. Did you know that by performing a simple test, which includes monitoring an aircraft's loadmeter and battery temperature sensor (if equipped), will help to determine whether thermal runaway exists?

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I DECIDED TO write this article in hopes of making the Army Aviation community more aware of the pros and cons associated with the nickel-cadmium battery we rely on so often to start our aircraft and to provide us a backup source of direct current (dc).

The vented nickel-cadmium (Nicad) batteries, used in Army aircraft, derive their name from the composition of their plates; nickel oxide on the positive plates and metallic cadmium on the negative. They are "vented," in that gases generated during the charging process can be expelled from the cells in a controlled manner. They are used to provide a source of dc power in both aircraft and nonaircraft applications. The following characteristics provide major advantages over other storage batteries. Vented nickle-cadmium batteries:

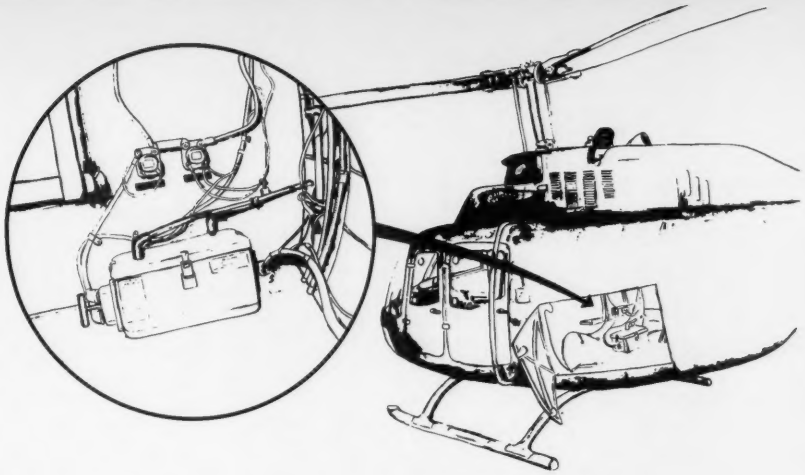
- maintain a relatively steady voltage when being discharged at high currents,
- can stand idle in any state of charge (fully charged, partly charged or discharged) without any damage,
- can be charged and discharged at a high current rate without causing permanent damage to the battery,
- can withstand extremely cold temperatures without damage,
- can withstand high levels of vibration and shock without failure,
- are composed of individually replaceable cells,
- have a long service life under severe conditions of use.

The battery unit itself consists of one or more cells, which are the basic building blocks of the battery. The number of cells will determine the total voltage rating and capacity of the unit. Each cell has a nominal voltage of 1.20 volts; however, the actual operating voltage of a cell will range from 1.2 to 1.3 volts. The average aircraft battery will contain 19 or 20 cells.

The principal parts associated with cell manufacture and operation are:

• *Plates (electrodes):* The sintered (a deposit formed by evaporation) plates of Nicad cells are made by a process in which carbonized nickel powder is sintered (to cause to become a coherent mass by heating without melting) at a high temperature to a metal carrier. The welding together of the individual grains of nickel powder onto the carrier results in a highly porous structure known as plaque. Positive (nickel) electrodes are formed by soaking the plaque in nickel salts and then subjecting the salt-impregnated plaque to an electric current. Negative (cadmium) electrodes are formed by the same process except that cadmium salts are used. Plates are formed by cutting the plaque to size and welding a nickel tab to a corner for connection purposes.

• *Electrolyte:* Normally, by weight, a 30-percent solution of potassium hydroxide in distilled water. It provides a path for conducting the current that flows between the positive and negative plates. The electro-



lyte does not take part in the chemical reaction in Nicad batteries, but acts as an ion carrier.

• *Separator:* A continuous, thin, porous, multilaminate of nylon and either cellophane or plastic, that keeps the positive and negative plates from coming into contact with each other and causing a short. These separators also have the added function of preventing oxygen, generated during overcharge, from coming into contact with the negative electrode and lowering the end-of-charge voltage. This separator material must resist degradation and thus reduce the possibility of "thermal runaway."

Once the basic materials discussed above are assembled, they are placed into a nylon case and fitted with a cover, terminal post and vent assembly, which allows gas to escape during the charge cycle.

The exact chemical reactions that occur within a cell of the Nicad battery during charge and discharge are open to question, particularly with regard to the reduced and oxidized states of the active materials. But, the essential operation is described and discussed below.

During charge, the charge current is applied to the cell. The cadmium-oxide material of the negative plates gradually loses oxygen and becomes metallic-cadmium, and the nickel-oxide active material of the positive plates is brought to a higher state of oxidation. These changes continue in both sets of plates as long as the charging current is applied, or until the active materials at the plates have been completely converted. The cell emits gas toward the end of this process because of the decomposition of the water component of the electrolyte as hydrogen gas at the negative plates and oxygen gas at the positive plates. The amount of oxygen generation is dependent on the degree of overcharge. Due to the excess of cadmium in the negative plates, hydrogen gas is released under prolonged overcharge conditions.

If gradual discharge is accomplished at this time, the reversal of the chemical process acts as a "relaxation" effect. This apparently strips the gas bubbles from the electrode surfaces causing depolarization. Also, the discharge pulses cause the negative plates to regain some oxygen and/or cause recombination of oxygen and hydrogen, thus greatly reducing the possibility of electrolyte emission and hydrogen/oxygen gas explosion. During this discharge process, the chemical energy is released as electrical current through the discharge load. The rate of chemical energy conversion is determined principally by the resistance of the load to current flow (the discharge rate).

The information above must be carefully considered as we continue to discuss our involvement with the Nicad battery. We have discussed the "pros" relative to this battery, the major components that make up each cell, and the theory behind cell operation. Below are some of the shortcomings associated with these batteries.

The cells that make up each battery are designed to produce about 1.2 to 1.3 volts nominal. Each cell is considered to be dead at about a voltage level of 1.1 volts. Based on this fact, it should be readily apparent why Nicad batteries have such a linear discharge rate up to the point of exhaustion. The battery may appear to have sufficient power for a safe, normal start only to find that it lacks the sustaining power necessary for the attempt. Because of this, indicated battery voltage is not a good means of determining battery condition.

Another important characteristic observed in Nicad batteries is the temporary loss of capacity or

"sleepiness" (also referred to as the "memory effect"). When this temporary loss occurs, the battery is unable to deliver its designed capacity. The loss-of-capacity effect is more common when recharging a battery across a constant potential bus,* such as in aircraft, than when charging with constant current. The loss of capacity is usually an indication of an imbalance between the cells due to differences in temperature, charge efficiency and self-discharge rate. This temporary loss-of-capacity effect should not be taken lightly. Even though a battery may *appear* to be giving satisfactory performance, it may deliver only a portion of its rated capacity during an emergency.

During a test conducted on 19-cell, 34-ampere-hours, 24-volt Nicad batteries, 30 were given a capacity test. The average capacity measured on the 30 batteries was less than 15-ampere-hours, or less than half of the rated capacity; 2 of the batteries delivered only 2-ampere-hours each. It is clear that the condition of the batteries would not be ideal under emergency conditions. To minimize the loss of capacity problem, Nicad batteries should be serviced periodically and given a deep cycle discharge to "0" volts.

Finally, a term that should be familiar to all who deal with the Nicad battery is "thermal runaway," a condition of overcharge instability caused by damaged gas barriers in the cell separator system. A battery with a damaged gas barrier, when overcharged on a constant-potential charging system, may experience abnormally high overcharge current that increases the battery temperature, electrolyte level, and causes abnormal emission of hydrogen and oxygen gases due to electrolysis of the water in the electrolyte solution. Destruction of the battery and equipment in which it is installed will result unless the charge current is quickly removed.

In the past, most thermal runaways have been caused by the breakdown of the cellophane film separator, enabling oxygen generated on overcharge to reach the cadmium electrode. This lowers voltage and increases current draw from a constant potential source. Plastic film separators, such as "Permion" or "Celgard," used in many Army Nicad batteries since 1979, will not break down in the alkaline environment of the cell as did cellophane. So, thermal runaway is less likely with these materials. Even with these new improved plastic materials, overheating and spewing of electrolyte can occur if excessively high charge currents and high temperatures are encountered.

How can we, as pilots, detect the onset of thermal runaway? Simple, just monitor the aircraft loadmeter (and battery temperature sensor if equipped). The loadmeter should indicate a gradual decrease in amperage as the battery is charged following use. If the loadmeter begins to increase for no apparent reason, the pilot should expect some type of electrical malfunction. This doesn't necessarily mean the onset of thermal runaway and may, in fact, be caused by failure of other electrical components or wiring associated with the dc system. Simply taking the battery off line should tell if the problem is battery related. A slight decrease in amperage should occur as the battery switch is turned off and there should not be a further increase in amperage. Remember, a dash 13 entry is always necessary to ensure that the problem is recognized by the maintenance people and subsequent flight crews.

Next, consider the current emergency procedure associated with an overheated battery. Turning the battery switch off removes the charging current from the battery and decreases the possibility of further overheating caused by charging. But, it also prevents the pilot from monitoring the condition of the battery to determine if flight may be safely continued.

Perhaps the procedure should be changed to reflect the additional knowledge we now have about our batteries. Instead of placing the battery switch off, we might want to turn the generator and alternator switch off. This would effectively remove the charge source, allow the pilot to monitor battery voltage, and discharge the battery through normal aircraft system usage. This should cause the "relaxation" effect (mentioned earlier) to aid in rectifying the thermal runaway condition and reduce the probability of aircraft damage due to electrolyte spewing or battery explosion.

Nickel-cadmium batteries are rugged and provide long life. But, they require proper handling and maintenance if they are to deliver designed output and are to have a maximum useful life. Always refer to the appropriate maintenance manual when performing regular preventive maintenance on Nicad batteries. *Never* allow voltage regulator checks to be performed improperly. These checks determine the proper charge current for the Nicad battery and are most important in the prevention of thermal runaway due to overcharge.

* Conductor, or assembly of conductors for collecting and distributing electric currents.

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I Caaaan't Hearrrr Youuuu!

Noise induced hearing loss is a problem that has been growing in the military since the inception of black powder. About $162 million was awarded in 1984 as compensation for hearing losses related to military service, and similar amounts can be expected to be paid in compensation in succeeding years. This article is intended to make men and women aware that noise hazards abound in the military.

AHHHHTINSHUT! Rrrrright hace! Forrrrrarrrrd harch! Hupt, twop, treep, hore!"

Does the preceding conjure up old memories, such as those "like to be forgotten" days of basic training? Remember those days when everybody ran to wait in line? Those days when you drank your "scrambled" eggs and used a knife and fork to "eat" your coffee? Those days when no one talked, everybody yelled?

Even when, in fact *particularly when*, a drill instructor was nose to nose with you, he still yelled. He, as usual, would yell an undiscernable mumbo jumbo which would frequently result in some dumbfounded expression on your part. You easily could hear his rantings as your ear drums would usually reverberate off one another. But, deciphering the mumbo jumbo was often impossible—the first time. Why was it, with more than 100 soldiers "counting" cadence, the drill instructor would stick his nose in your face and yell—well above the "yelling" of the other 99 trainees—"I caaaan't hearrrr youuuu?" Was the man deaf?

Such were my thoughts some 15 years ago. Being young and awfully naive I didn't see the "writing on the wall." I didn't realize, that along with traditional military disciplining, an insidious warning was ringing in my ears. So, here I am, 15 years later, wearing a hearing aid because I am going deaf. And, you may be too. Statistics show that newly arrived basic trainees lose 5 percent of their hearing ability by the end of their basic training cycle. These same trainees lose, statistically, another 6 percent of their hearing acuity by the time they complete their advanced individual training cycle. By the time these soldiers complete 10 years of military service *less than half* still have hearing capabilities within the "normal" range[1] (see accompanying figure). The rest of us yell.

It was reported in 1972 that the Veterans Administration paid $58 million for military service related

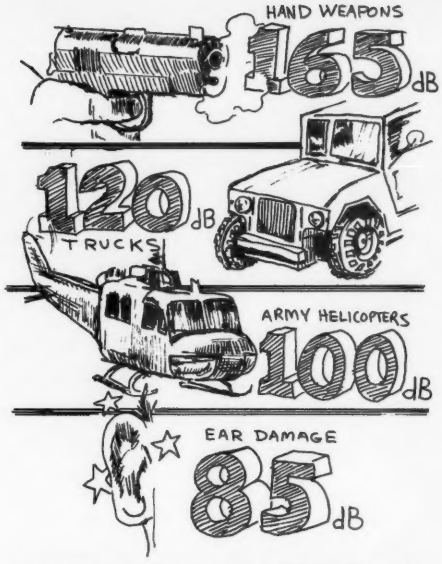
hearing losses.[2] And, the problem isn't going away. Congress allocates more than $100 million annually for these military service related disabilities.[1] Certainly one could argue a significant number of these disabilities are directly related to combat duty, but our last "conflict" ended in 1974 and the hearing losses continue. Why?

Why do hearing losses occur in peacetime? Why are we spending millions of dollars annually in compensation rather than prevention? Why are we training to send our soldiers into combat handicapped with a hearing impairment? Soldiers assigned to night listening posts after riding, unprotected for a period of time in a gamma goat (personnel carrier), probably would be able to hear a herd of elephants out for an evening stroll; but, due to the trauma of their previous noise exposure in the gamma goat, and the resultant tinnitus (ringing in the ears) and temporary threshold shift of their hearing acuities, they would not be able to hear more meaningful sounds. Likewise, soldiers suffering significant hearing losses may not hear, or may misinterpret, a crucial order at a critical time. Nowhere is acute hearing so valuable as it is in combat. Yet as we train for combat, statistically, half of our soldiers are suffering significant hearing losses.

Obviously the military uses a lot of noisy equipment and many factors contribute to this dilemma. The characteristics of the equipment, current technology and of course economics are a few such factors.

Impact noises from small arms and crew-served weapons can exceed 165 decibels.[3] Ear pain is experienced between 120 and 140 decibels with irreparable damage to the ear occurring at far lesser values—legislatively above 85 decibels.[4] Exposures to weapons fire for semiannual POR (preparation of replacements for overseas movement) are normally well controlled and, in accordance with Army Regulation (AR) 385-63, earplugs are normally checked out and worn. Unfortunately with the emphasis, rightly so, on more realistic training and "combined arms exercises" in a less controlled field training exercise environment, harmful exposures without the benefits of hearing protection tend to be the normal course.

Gamma goats, 2½ ton trucks, generators and other equipment generate noise in excess of established safe limits and can often border on the threshold of pain (120 decibels). Although noise hazards warning placards, reflecting mandatory use of hearing protectors, are usually visible to the vehicle or equipment operator, such warnings are not available



Many common, everyday sounds of military life are far above the 85 decibels of steady noise listed as being hazardous by AR 40-5.

to all vehicle passengers or other personnel in the immediate vicinity of the noise source. I have witnessed gamma goat drivers proudly wearing appropriate hearing protection while, paradoxically, their codrivers and passengers have taken no measures to protect their hearing. There is no excuse for this, nor for leaders who instruct their troops to "sandbag" noisy generators yet make no mention to them about wearing hearing protectors while working in the vicinity of the offending noise.

The greater use of military aircraft, particularly helicopters, has substantially increased soldiers' exposure to noise. Helicopter crewmembers wear fire retardant flight suits and strange looking helmets with "Mickey Mouse" ears. These "ears" are hearing protectors. Noise levels in Army aircraft, on the average, exceed 100 decibels across the frequency range, and in the lower frequency ranges (below 500 hertz) may exceed 110 decibels.[5] Development of the air-land battle and air assault doctrine subjects an increasing number of soldiers to daily hazardous exposure from these noise sources. Yet, soldiers being transported by helicopters have little (if any) hearing protection. Even in "realistic training," time is afforded for the troops to "buckle-up" seatbelts; but few efforts are made to "plug-up" with hearing protection.

Whether it be from weapons fire, equipment operations or vehicle operations, soldiers are exposed almost constantly to hazardous noise levels. Leaders and troops alike need to take every sensible precaution to protect the hearing acuity of their troops and themselves.

Army Regulation 40-5 places hearing conservation responsibilities with commanders,[4] right along with their responsibilities for training, feeding, housing, maintaining and the like. Subsequently, hearing conservation efforts in too many units are minimal due to their place on the hierarchy of chores for commanders. Additionally AR 40-5 states, "Hearing conservation measures will be initiated whenever hazardous noise levels are known or suspected."[4] Experience has shown most soldiers—troops and leaders alike—are not cognizant of what a hazardous noise level is. AR 40-5 identifies "85 decibels on the A scale (dB(A)) for steady state noise and 140 decibels (dB) for impulsive noise"[4] as hazardous; but what is 85 dB(A) or 140 dB? You have always been exposed to weapons fire, to gamma goats, helicopters, generators and lawn mowers. You can agree they are loud and noisy, but "you're used to it" or "it doesn't bother you any more." Speak up! I caaaan't hearrrr youuuuu!

Some directives, i.e., AR 385-63, "Policies and Procedures for Firing Ammunition for Training, Target Practice and Combat," mandate the use of "proper hearing protection . . . by personnel engaged in firing."[6] Others, like Army Technical Bulletin (TB) MED 501, "Hearing Conservation," offer help for line commanders. TB MED 501 is designed to implement Department of Defense Instruction 6055.3, "Hearing Conservation." Other resources available to line commanders include local safety, occupational health or audiology offices or programs.

Leaders and troops alike must recognize hazardous noise levels just as they recognize harmful chemical agents. Good hearing conservation efforts must be mandated just as are good physical fitness efforts.

While guidance for effective military hearing conservation programs has been published, it remains a medical responsibility to provide line commanders with information and the tangible tools needed in the conservation of this vital combat asset. Baseline and/or annual audiograms should be a part of the POR with individual audiometric profiles and evaluations returned to commanders for their determination.

Earplugs and a carrying case should become a mandatory part of the duty uniform with the same emphasis applied as is with the wear of proper insignia and headgear. These plugs and cases should become items of inspection on all inranks inspections right along with haircuts and shined boots. All military personnel should be considered as working in noise hazardous environments, and training programs should emphasize the effects of noise on combat readiness as well as the effects on individual physiology. Commanders could then better direct and police the use of hearing protectors as they deem appropriate in their hearing conservation programs.

Stop, look or more appropriately *listen*! Are you now "used to" some loud noises? Can you still hear people walk across the carpet? Do you hear as well today as you once did? Do you need to save what hearing you have left? One day soon, will you be sticking your nose in some basic trainee's face shouting, "I caaaan't hearrrrr youuuuuuuuuuuuuuuu?"

Hearing loss is a serious problem in the military, and a real problem for servicemembers. But it need not be. *Always* carry hearing protectors, and use them. Look for those indications that point out the hazards: crewmembers or operators wearing hearing protection; warning placards or signs; headaches; pain or simple annoyance. Then take action. Consider how handicapped you would be in combat, as well as in everyday life, if your hearing were seriously impaired.

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Crosswind Landing Technique

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Directorate of Evaluation and Standardization
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DID YOU EVER stop to realize that there are only three conditions or situations in landing an airplane when both main gear touch the runway precisely at the same instant, and some crosswind corrections are not required?

The three conditions are covered near the end of this article. But, it will be helpful to read the following information before you get to the conditions. When you have finished reading the whole article you will have a better understanding of the aerodynamics involved when correcting for crosswinds.

The aircraft should always touch the runway with the longitudinal axis as nearly aligned with the runway as possible. This not only ensures maximum directional control during afterlanding roll, but it also keeps sideloads on the landing gear to a minimum. Remember the landing gear assembly is not designed for abnormal sideloads.

The crosswind charts and graphs depicted in the operator's manual are determined by the maximum use of aileron and rudder control available.

Suppose you are on final approach with the crosswind near the maximum allowed according to your charts (remember you have most of the available rudder applied to maintain directional control), when suddenly the crosswind velocity or component increases. Wouldn't you like to have an "ace in the hole"? Sure! Here it is: *differential power.*

The correct use of differential power during crosswind landings can greatly assist in maintaining aircraft control and provide a greater margin of safety during strong and gusty crosswind conditions.

The best technique is to establish the wing low (slip method) well out on final approach. As you lower the upwind wing to counteract drift, the nose will tend to turn toward the low wing. To prevent this turning moment and to keep the fuselage aligned with the runway, sufficient rudder is required to maintain directional control. In light to moderate crosswind conditions rudder control alone is usually sufficient. As the force of the crosswind increases, the upwind wing will have to be lowered more, thus requiring additional opposite rudder to maintain directional control. *Note: Most crosswind limitations are based on conditions that require the maximum use of rudder control to maintain directional control.*

The use of differential power (asymmetrical thrust) will assist in maintaining directional control. The recommended *technique* is to initially use rudder. As the rudder travel approaches half to three-quarters of full rudder, increasing power on the upwind engine will cause the nose to yaw toward the high wing, thus requiring less rudder travel to maintain directional control. This allows remaining rudder travel to be used instantly if gusty conditions occur on short final, roundout or touchdown.

If differential power is used on final approach, as power is reduced during roundout and touchdown, the corresponding amount of differential power should remain relatively the same. If you have 300 lbs of torque on the upwind engine and 200 lbs on the downwind engine, you reduce power to 200 lbs on the upwind engine, and to 100 lbs on the downwind engine (and so on) until the aircraft is firmly on the runway with little or no power on the downwind engine and only a slight amount of power on the

upwind engine. This is a safe, proven technique that provides more rudder control when it is needed the most.

Now, if you haven't already figured it out, the only three conditions under which both main landing gear should touch the runway at precisely the same instant are:

- *Calm wind conditions.*
- *Exact headwind or wind directly down the runway.*
- *Exact tailwind or downwind directly down the runway.*

Under all other conditions the upwind main landing gear will (should) touch the runway first. Any attempt to level the aircraft at the moment of touchdown may allow the aircraft to start a sideways drift. Touchdown in a drift or a crab increases the amount of sideloads and stress imposed on the landing gear and deteriorates the controllability of the aircraft during touchdown and afterlanding roll.

Use of differential power assists in turning the aircraft, especially in situations requiring short radius turns, and alleviates the need for excessive braking.

Use of differential power while taxiing in a strong crosswind assists in maintaining directional control and lessens the amount of opposite rudder or braking required to maintain directional control. Also, some use of differential power initially, during takeoff roll will assist in maintaining directional control.

Practicing the use of differential power during taxiing greatly enhances throttle control "touch" during normal takeoffs, crosswind takeoffs and crosswind landings.

This article does not imply or otherwise authorize deviation from the limits prescribed in the crosswind component charts as published in the aircraft operator's manual.

DES welcomes your inquires and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Ft. Rucker, AL 36362-5000; or call us at AUTOVON 558-3504, FTS 533-3504 or Commercial 205-255-3504. After duty hours call Ft. Rucker Hotline, AUTOVON 558-6487 or 205-255-6487 and leave a message.

U.S. Army Class A Aviation Flight Mishaps

	Number	Flying Hours (estimated)	Rate	Fatalities	Total Cost (in millions)
FY 85 (to May 31)	34	989,585	3.44	27	$69.6
FY 86 (to May 31)	21	1,003,226	2.09	19	$46.7

ARMY 008! Can You Assist Aircraft in Distress?

Major Thomas L. Reynolds
U.S. Army Aviation Engineering Flight Activity
Edwards Air Force Base, CA

The 1986 Army theme is values. This article revolves around the value Americans place on life, and consequently the extents to which they will go to assist others in distress. Congratulations to the crew of the U-21, the people at Duluth tower and approach, and to those at Cloquet airport. Your actions clearly reflect that Americans consider the value of life to be precious. This trait helps guarantee the freedom Americans cherish.

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DULUTH TOWER, this is Army 18008. Ready for takeoff."

"Army 18008, hold your position."

Long pause.

"Army 008, can you assist an aircraft in distress?"

Army 008 is a U-21 Ute airplane stationed at Edwards Air Force Base, CA. Its crew that day consisted of two experimental test pilots from the U.S. Army Aviation Engineering Flight Activity (USAAEFA) where aircraft are evaluated for performance, handling qualities, and effects of adverse environmental conditions.

"Tower, 008, that is affirmative. Can you give us some details?"

"Affirmative, 008. A civilian Aircoupe, VFR-on-top (visual flight rules) has developed a fuel leak. He estimates he has only 15 minutes of fuel remaining. We would like to vector you to his position and give you further details while you are en route."

"Roger, tower."

"Army 008 cleared for takeoff."

It had been a typical day until the crew received this call. The Army aircraft and crew had been operating out of Duluth, MN, for about 1 month, conducting natural icing tests of the Army's newest attack helicopter, the AH-64 Apache. The U-21 was equipped with the latest instrumentation to measure the important parameters of clouds: temperature, liquid water content and particle size. It acts as the bloodhound of the icing test team, looking for ice in the clouds.

Once the ice is located, the crew reports its location to the other test pilots in the Apache. If not already airborne, the Apache launches, flies to that location and accumulates the desired amount of ice on the aircraft. The two aircraft then join up above the clouds to document the ice buildup on the Apache, using high resolution video cameras aboard the U-21.

"Army 008, turn to heading 180, contact approach on 125.8."

"This is 008, WILCO."

"Army 008, this is Duluth approach. The aircraft is at your 12 o'clock, 5 miles, altitude, 5,000 feet. We'd like you to join up, and have the Aircoupe fly a formation approach on you into Cloquet."

The weather was rather typical for December in Duluth. The ceiling in the area varied from 500 to 700 feet. The cloud tops (low that day) measured at 3,000 feet. The pilot of the Aircoupe was not instrument rated. He had taken off from Hibbing, MN, earlier that morning en route to St. Paul, MN. Because of the low ceilings he chose to climb VFR through a break in the clouds and then fly VFR-on-top. About 45 minutes into his flight, he noticed a fuel problem. He quickly realized he did not have enough fuel to make it to St. Paul.

Even though St. Paul was reporting VFR conditions, the ceiling in the vicinity of Duluth and Cloquet was solid. He didn't have a good VFR destination in the immediate vicinity. To complicate matters more, the one airport in his vicinity, Cloquet, had only a nondirectional beacon (NDB) approach. He was not NDB equipped.

The pilot in command of the U-21 was USAAEFA's only civilian test pilot, a former Army major named Bob Robbins. In the thousands of hours of flight time he had accumulated in his career, he had never encountered this type of situation. His mind was racing with ideas and thoughts. There were six people aboard the U-21: Robbins, his copilot, an aeronautical engineer, the Apache's flight test engineer, a video operator and a photographer. He didn't want to risk the life of anyone aboard. The Aircoupe could only maintain 100 mph, a speed uncomfortably slow for the U-21.

The pilot of the Aircoupe probably had minimum instrument experience, and had probably never flown formation in his life. Flying formation is difficult under VFR conditions, and almost impossible in the clouds. Would the pilot be able to maintain control in the clouds? Or would he lose control when the windscreen was blanked out with clouds? Could the U-21 possibly fly formation on the Aircoupe, or would the pilot make such erratic control movements that it would be impossible?

"Duluth approach, this is Army 008. Negative on the formation approach. We would like to join with the Aircoupe and talk him down on an approach to Cloquet."

"Roger 008. We have cleared all other traffic from this frequency. The Aircoupe is at your eleven-thirty, one mile."

"Roger approach, contact."

Within a few seconds the Aircoupe zipped past, 500 feet above the U-21 and flying in the opposite direction. The U-21 was banked hard and full power was applied to link up with Aircoupe. By now the Aircoupe had only 6 to 7 minutes of fuel remaining. The U-21's radio navigation was tuned to a waypoint that corresponded to the airport's location. The distance measuring equipment indicated 8 miles to go. The NDB approach showed a 005 degree inbound course. The two aircraft were on the 030 degree inbound course heading north, but if the Aircoupe pilot was to make it, he would have to immediately start his descent!

Robbins communicated his intentions to the pilot of the Aircoupe. He would talk him down, giving directions in the same way a ground controller would. Following the pilot's acknowledgement, Robbins instructed the Aircoupe to descend to 1,760 feet, the minimum descent altitude for the approach, and to report reaching visual meteorological conditions below the clouds. As the Aircoupe descended through the clouds, Robbins maintained altitude and followed his own heading commands. Assuming the pilot of the Aircoupe followed the directions precisely, the U-21 should be directly above it flying the same speed and heading.

During the 2 minutes it took the Aircoupe to descend through the clouds, the atmosphere in the cockpit of the U-21 was tense. Robbins had never done anything like this before. Would it work? Would we hear from the Aircoupe again? It seemed like an eternity!

"Army aircraft, this is Aircoupe. I've broken out below the clouds."

The people aboard in the U-21 breathed a sigh of relief. The most crucial portion of this operation was successful. The Aircoupe was VFR below the clouds. *But time was still critical!*

"Roger, Aircoupe. Turn to heading 030 degrees, the airport should be at your 12 o'clock, 4 miles ahead."

"Roger, Army. It's going to be a long 4 miles, my fuel gauge just went to zero."

The voice of the pilot was calm, but the severity of the situation was apparent to everyone involved. Robbins continued to communicate directions and distances to the pilot of the Aircoupe: 3 miles, 2 miles, 1 mile. The Aircoupe should be right over the airport, but the pilot still did not report it in sight.

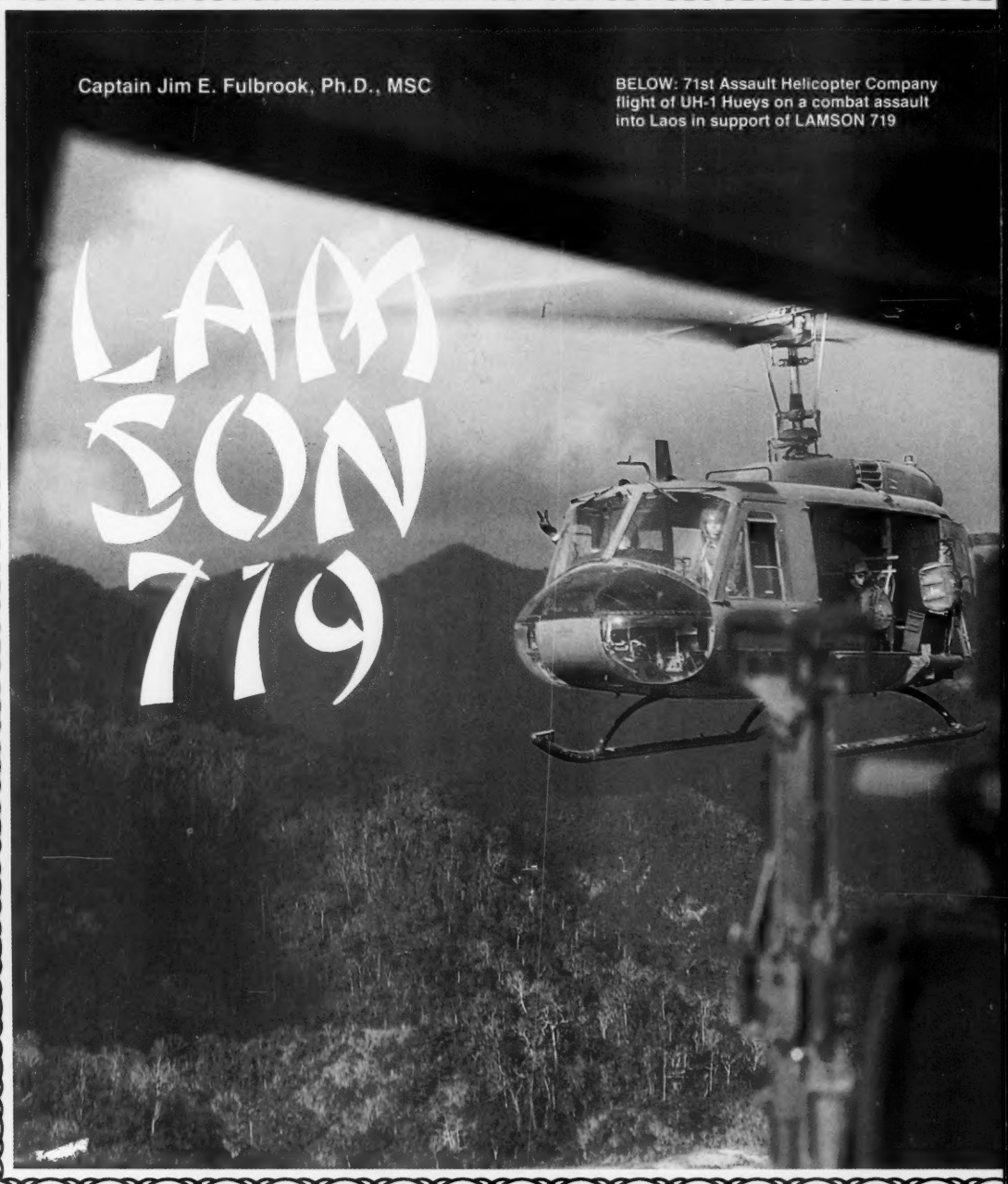
At that moment an observer at Cloquet reported to Duluth approach that the Aircoupe had just *overflown* the airport. As luck would have it, approach still had the Aircoupe on radar.

"Aircoupe, this is Duluth approach, you are 1 mile northwest of the airport. Turn right to heading 240 degrees."

"Roger, approach. I have the airport in sight."

Four hundred feet after the Aircoupe landed, its engine quit. It had to be towed off of the runway. The crew of the U-21 let out a cheer. But there was no time to celebrate. The Apache had already launched and there was still an icing mission to accomplish.

Captain Jim E. Fulbrook, Ph.D., MSC



BELOW: 71st Assault Helicopter Company flight of UH-1 Hueys on a combat assault into Laos in support of LAMSON 719

Part II: The Battle

AH-1G Cobra gunships rearm at Khe Sanh.

LAST MONTH "Part I: Prelude To Air Assault" presented a review of the history of the Vietnam War leading up to LAMSON 719, the most significant airmobile/air assault[1] battle of the war, and the only historical example of contemporary Army Aviation operating in a mid-intensity conflict. Part I defined the levels of conflict. It also described Army Aviation missions and units, concepts of fire support bases, and airmobility in the Republic of Vietnam.

Part II describes the immediate events leading up to LAMSON 719,[2] the operations order, the battle itself and the battle statistics. Next month, Part III will conclude with a review of battle statistics and discuss some reflections and values of lessons learned from LAMSON 719 and from the

[1] Going into the Vietnam War, "airmobile" was used to describe Army Aviation helicopter operations. As helicopter tactics emerged and were refined, armed helicopters became better and better equipped to attack the enemy with gunships and to supply and carry troops in transport helicopters into the attack. Air assault then became a term that meshes together airmobile operations with the ever-increasing development and refinement of gunships (firepower) and troop carrying helicopters in air assaults (mobility).

[2] Several South Vietnamese operations were named "LAMSON" after the birthplace of a Vietnamese hero who led an army to expel the Chinese from Vietnam in the 15th Century. The use of "719" signifies the year "1971" and the battle area along Route 9.

U.S. military involvement in Vietnam in general.

The Ho Chi Minh Trail
(Figures 1 and 2)

After North Vietnam lost the use of the resupply port at Kompong Som in Cambodia in 1970, all supplies and reinforcements had to be brought down the Ho Chi Minh Trail through Laos. With the successful offensive of U.S. and South Vietnamese troops into Cambodia, also in 1970, the North Vietnamese Army (NVA) had to dramatically increase activity on the Ho Chi Minh Trail to try to reconstitute their forces in the south.

Even though the Ho Chi Minh Trail network had been continually bombed for years, by late 1970 the Communist supply system had been greatly improved. The trail system spread out over Laos like a spider web of between 3,500 to 8,000 miles of roads and trails. More than 150,000 Communist volunteers, soldiers and forced laborers built and maintained the trail system. During this time some 5,000 to 14,000 trucks traveled along the trail network usually at night to avoid detection. The North Vietnamese even had a 4-inch fuel pipeline that ran from North Vietnam as far south as the A Shau Valley.

The trail system was divided into command centers, transshipment points, base areas and way stations which were called "binh trams." Each binh tram operated as a complete logistical center with its own area of responsibility. Binh trams had medical, engineering, storage, transportation and maintenance support as well as infantry and antiaircraft troops to provide security.

The Ho Chi Minh Trail was further divided into three routes. Trucks only carried heavy supplies and went on one route. Light equipment and supplies were carried by people, bicycles and animals on another route. Combat troops marched on foot on still another route, often in troop strengths as high as 600 people. It could take foot soldiers up to 100 days to reach their destinations in South Vietnam. Depending on the type of route, each binh tram was located a day's movement apart. The two largest Communist base areas found along the Ho Chi Minh Trail were designated "604" and "611": These became the principal targets of the LAMSON 719 operation.

The Laotian panhandle experiences two seasons each year. Most supplies were moved along the Ho Chi Minh Trail in the dry season from October to March. For the rest of the year monsoon rains severely limited traffic.

All of the factors of season, troop and supply buildup on the Ho Chi Minh Trail, and willingness to incur into Communist territory, as demonstrated by the U.S./South Vietnamese Cambodian offensive, were common knowledge to both sides. The Communists expected an attack into Laos. But, rather than abandon their base areas and supplies to avoid a decisive defeat, as they did earlier in Cambodia, the Communists upgraded their defenses and troop strength to stand and fight. By the end of 1970, an estimated 18,000 additional combat troops, including 20 antiaircraft battalions, were sent to Laos to reinforce base areas 604 and 611. These units were equipped with several hundred 12.7 mm (50 caliber) and 14.5 mm antiaircraft guns; 23 mm cannons; and 37 mm, 57 mm, 85 mm and 100 mm antiaircraft assets among an estimated 3,000 prepared emplacements over the Laotian panhandle.

In the mountains and jungles of Laos there were few sites suitable as helicopter landing zones (LZs). The North Vietnamese triangulated these clearings and much of the high ground with antiaircraft weapons, and preregistered their mortars and artillery to zero in on the potential LZs. By the end of 1970, North Vietnam had three infantry divisions, two artillery regiments, and one armor regiment in the 604/611 base areas, with eight additional regiments available within 2 weeks as reinforcements from other areas.

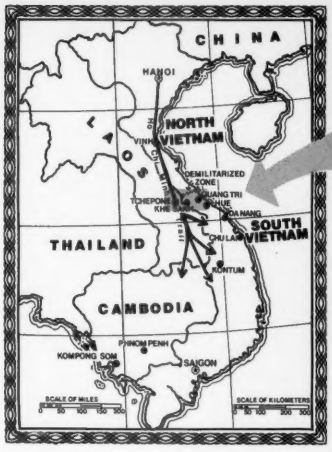
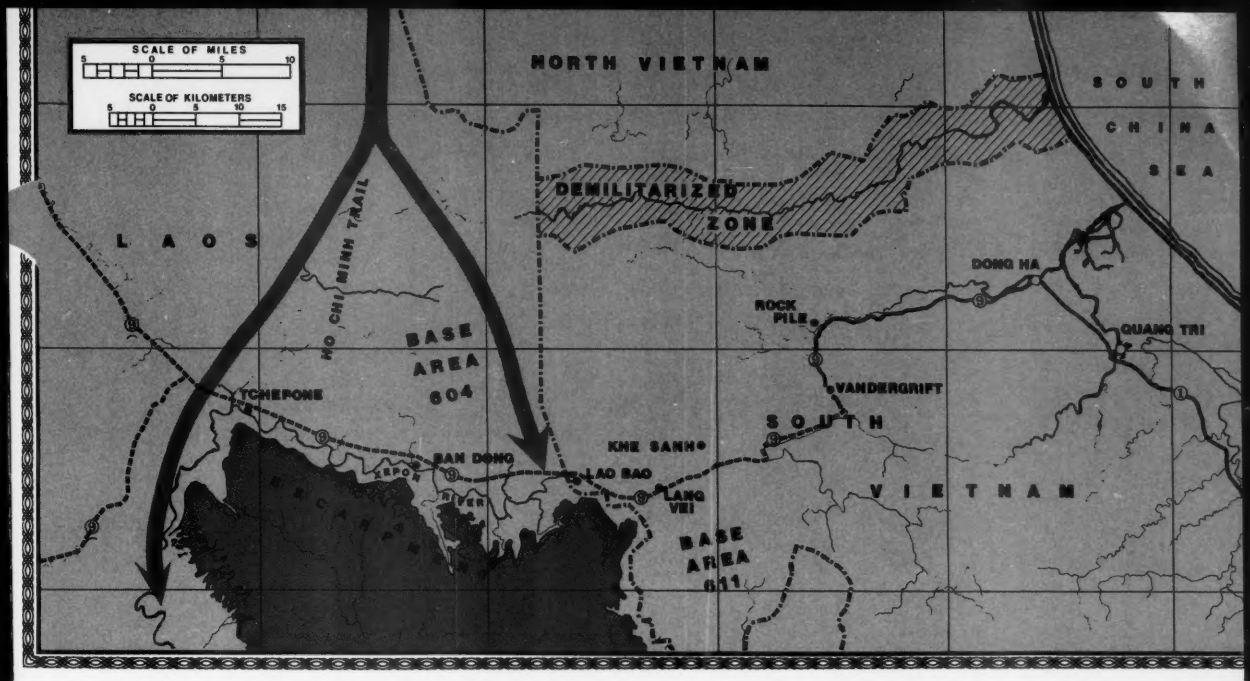


FIGURE 1 (ABOVE)

FIGURE 2 (RIGHT)

The Americans and South Vietnamese were alarmed by the serious buildup of activity along the Ho Chi Minh Trail. Intelligence reports indicated that the North Vietnamese were planning offensives against Cambodia and several provinces of South Vietnam at the end of the dry season. A preemptive strike was tempting and a risk worth taking. The South Vietnamese and Americans had turned the war around and were on the offensive. In December 1970 the U.S. proposed an offensive which was quickly approved by the South Vietnamese.[3] Joint planning for LAMSON 719 began in January 1971 with barely a month to work out operations plans and to prepare units.



The principal objectives of LAMSON 719 were to interdict and disrupt the flow of enemy troops and supplies into South Vietnam along the Ho Chi Minh Trail in Laos. LAMSON 719 would be the first major test of the Vietnamization effort.[4] No American ground combat troops or advisors would accompany the Army of the Republic of Vietnam (ARVN) in the attack against the Ho Chi Minh Trail. LAMSON 719 would be the greatest test of airmobility/air assault and fire support base (FSB) concepts. It would hopefully cripple North Vietnam's ability to launch any offensives and buy more time and safety for the continued withdrawal of U.S. troops. And, hopefully, it would enhance peace negotiations which were already underway.

LAMSON 719 Operations Plan.

The operations plan proposed four phases.

Phase I called "Dewey Canyon II," would be a U.S. operation to reopen the base at Khe Sanh and clear Route 9 up to the Laotian border.[5]

Phase II would be an ARVN infantry and armor attack down Route 9, with northern and southern attacks to establish FSB protection on the flanks. The Phase II objective was the town of Tchepone, some 40 kilometers or nearly 25 miles west into Laos. The operational area was 10 to 20 miles wide from north to south, closing in on Tchepone.

Phase III would be the exploitation phase when ARVN troops would fan out to conduct search and destroy operations against enemy troops and bases.

Phase IV involved the orderly withdrawal of ARVN troops from Laos. The operation was to last up to 90 days or until the onset of the rainy season.

[3] Interestingly, it was during White House discussions on LAMSON 719 that President Richard M. Nixon first had voice-activated recording equipment installed in the Oval Office to record the history of his administration. Ironically, this led to his downfall by resignation and, to a large degree, the downfall of South Vietnam in 1975 when Congress withdrew support to South Vietnam and President Nixon was powerless to react to the North Vietnamese invasion.

[4] The Vietnamization effort was intended to develop, through training and equipping, South Vietnamese military forces to the point that they could stand alone and defeat the Viet Cong and North Vietnamese forces.

[5] "Route 9," also known as "Highway Nine," was a two-lane paved road that ran from Quang Tri to FSB Vandergrift. From there it was a one- to two-lane dirt road to Laos.

LAM SON 719

Although the term was not mentioned in afteraction reports, LAMSON 719 was to be an airmobile "deep battle" or attack, wholly dependent on U.S. helicopter support for resupply and troop insertions and extractions. FM 101-5-1 defines a deep battle as all actions that support the friendly scheme of maneuver and which deny to enemy commanders the ability to employ their forces (not yet engaged) at the time and place, or in the strength of their choice.

LAMSON 719 also was to be the most significant "combined operation" in the Vietnam War because U.S. advisors would not accompany the ARVN troops into Laos. FM 101-5-1 defines a combined operation as an operation conducted by forces of two or more allied nations acting together for the accomplishment of a single mission. In previous U.S./ARVN operations, U.S. advisors usually served as fire and air support coordinators, and frequently served as command and control in air assaults with U.S. helicopters. In support of LAMSON 719, the United States would commit more air and artillery support to a single battle than at any time during the Vietnam War.

The ARVN units were supported by U.S. Army units of the 24th Corps, but principally, and for all aviation operations, by the 101st Airborne Division (Airmobile). Nearly 700 helicopters and 2,000 fixed wing aircraft were committed to the battle. Estimates ranged as high as 50 percent of U.S. air assets in South Vietnam being committed to the operation. The total American force numbered about 10,000 troops consisting of the equivalent of about six combat aviation battalions, four infantry battalions, three artillery battalions and battalions of mechanized infantry, engineers, military police and other support personnel.

The ARVN force involved nearly 20,000 troops containing about 42 battalion-size units, 34 of which were committed in the Laos operation. These units included the ARVN Airborne Division, a Marine division, the 1st Infantry Division, the 1st Armor Brigade and the 1st Ranger Group. These were the elite of South Vietnam's Army, leaving only about a battalion in their entire national reserve.

Phase I: Dewey Canyon II. Phase I was launched on 30 January 1971 with brigades of U.S. mechanized infantry clearing Route 9 and an infantry brigade quickly securing the Khe Sanh area in a helicopter assault. Little opposition occurred and in a few days the airstrip was repaired and artillery units dug in. During this time the ARVN units assembled in the Khe Sanh area and prepared for the attack.

Phase II: The Attack. The ARVN attack into Laos began on 8 February and consisted of three main thrusts (maneuvers can be followed by referring to figure 3). Several battalions of armor and infantry, plus an engineer battalion, crossed the border into Laos on Route 9. Several units from the 1st Infantry Division were helicopter assaulted south of Route 9 to es-

LEFT: The Rock Pile, a well known terrain feature along Route 9.

BELOW: Fire Support Base Vandergrift at the bend in Route 9.

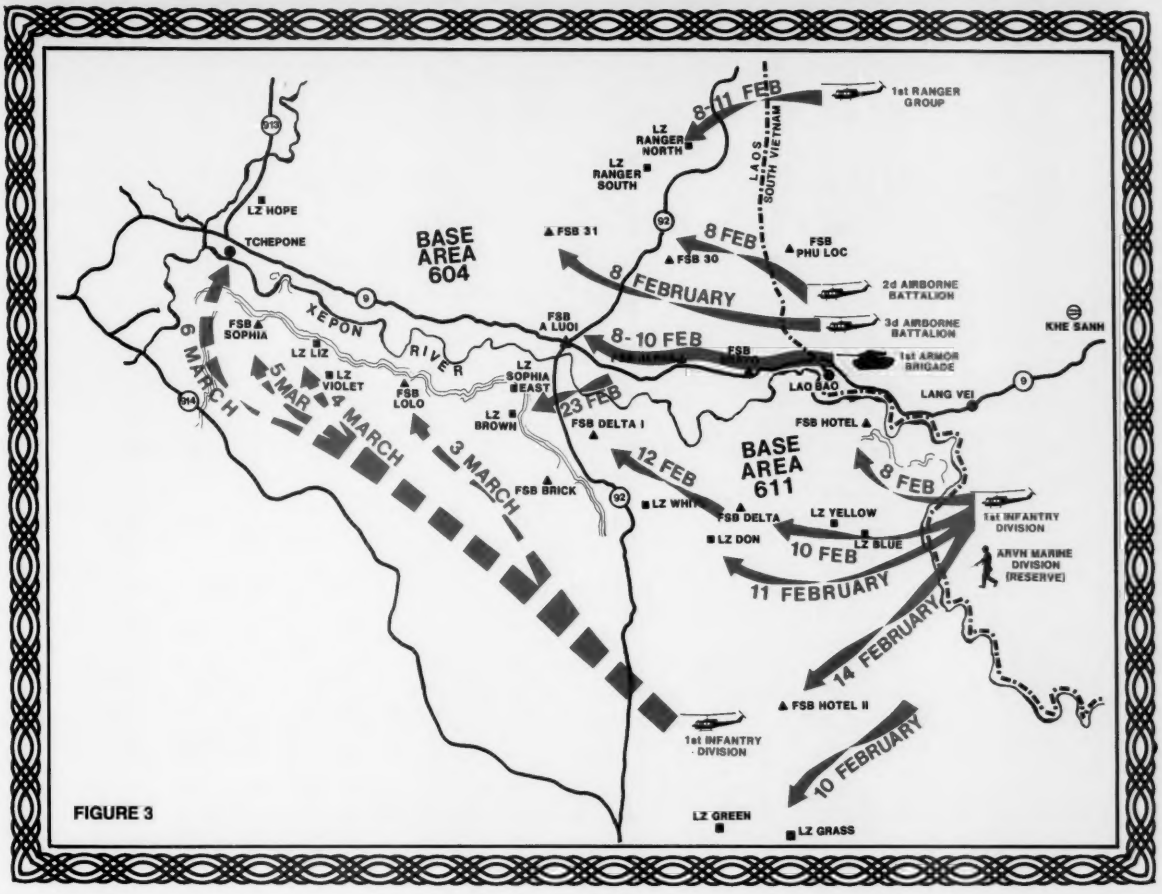


FIGURE 3

tablish FSBs HOTEL and DELTA on 9 February. North of Route 9, airborne and ranger units were helicopter assaulted to establish FSBs on LZs 30, 31 and RANGER SOUTH.[6] Only the RANGER SOUTH assault received significant antiaircraft fire, quite possibly because nearly a dozen B-52 bomber strikes were made before the attacks and dozens of helicopter gunships assisted in the attacks.

On 10 February, a helicopter assault landed an airborne battalion on Route 9 at Ban Dong and established an FSB named A LUOI. Later that day the armored column reached A LUOI, which was halfway to the objective—Tchepone. From this point on, enemy resistance and antiaircraft fire began to increase on a daily basis. A number of helicopters were shot down from the 10th through the 13th of February as FSBs were set up and bolstered on 30, 31, A LUOI, RANGERS NORTH and SOUTH, HOTEL, DELTA and DON.

For nearly a week, units of the 1st Infantry Division on the southern flank conducted *Phase III* operations searching out and destroying enemy troops and supplies. Virtually everywhere the ARVN troops went they found supply caches and the bodies of enemy soldiers killed by U.S. air strikes. Several other FSBs and LZs were established on the escarpment as far west as DELTA 1. Unfortunately, the armored column did not move. This took away valuable time that the ARVN forces needed to react and allowed the Communists the advantage of more time to counteract. On the northern FSBs, ranger and airborne units became more and more decisively engaged. Helicopter assaults to LZ GREEN in the south were broken off be-

[6] There is a difference between an LZ and an FSB. An LZ that had artillery pieces airlifted and emplaced was renamed an FSB.

Although not clear, this photo taken on 6 March 1971 shows an aerial view of Khe Sanh just prior to the largest combat air assault in Army Aviation history. The dark specks around the two runways are UH-1H helicopters loading ARVN troops.

cause of intense enemy antiaircraft fire, and ARVN forces around LZ GRASS were in continuous enemy contact.

By 19 February the North Vietnamese had reinforcements in place. Large numbers of troops and trucks were seen in the northern area converging on the ranger bases, which had both come under serious attacks. Intense allied air and artillery strikes hit the enemy around the beleagured ranger positions. But, by the morning of 20 February the enemy was so close to the wire perimeters of RANGER NORTH that helicopter landings were tenuous at best. Attempts to resupply and medical evacuate troops from RANGER NORTH resulted in several helicopters being shot down.[7] That afternoon the base was overrun. Three days later RANGER SOUTH was abandoned before it too would have been overrun.

The ARVN lost nearly 300 troops in the defense of the RANGER FSBs, but a much greater toll had been taken on the enemy (more than 600 killed). Using ranger and airborne units on the northern flank was a tactical error. These units were light infantry and did not have the firepower that the ARVN 1st Infantry Division possessed. While the rangers were beaten, they showed remarkable courage and tenacity in defending for as long as they did against rocket, mortar, artillery fire and "human wave" attacks.

From 23 February to 2 March the airborne units on FSBs 30 and 31 bore the brunt of the North Vietnamese counterattacks. ARVN infantry forces to the extreme southern positions also were under increased enemy pressure. By the end of February several units were extracted from the southern bases (HOTEL II and GREEN) and redeployed by helicopter farther west on the escarpment to DELTA 1 and BROWN. On 27 February an airborne battalion was inserted into FSB ALPHA to secure and hold open Route 9 to the south.

The most far-reaching battle for the ARVN came 25 February at FSB 31. The airborne troops had been under attack for days, but that afternoon they came under a three-pronged conventional assault by some 20 PT-76 and T-54 tanks in conjunction with an estimated 2,000 infantry. Despite being greatly outgunned and outnumbered, the ARVN troops fought off two assaults with the help of tactical aircraft and artillery that destroyed several enemy tanks just inside the ARVN defenses. On a third attack FSB 31 was captured. Once again the Communists lost many more troops than the ARVN, plus 11 tanks on the assault, but the hill was in enemy hands. Based on intelligence estimates, it quickly became quite clear that the enemy had more artillery, tanks and combat troops than expected.

The airborne troops on FSB 31 were supposed to be rescued by an armored column moving north from Route 9, but the column never reached them in time. Between 25 February and 2 March this armored column and another fought the first head-to-head armor battles of the Vietnam War. The ARVN performed well in these battles and with the help of U.S. air strikes, decimated nearly 1,500

[7] From one of the aeromedical evacuation helicopters medical specialist SP4 Dennis Fujii was wounded and became stranded on the base. SP4 Fujii remained to help treat wounded and coordinate close air strikes before being picked up on FSB 31. The rescue aircraft was seriously damaged and crash landed on FSB 30. The next day SP4 Fujii and a score of wounded ARVN soldiers were evacuated. For his valor SP4 Fujii received the United States' highest award—the Medal of Honor.

A unit of M109, self-propelled, 155 mm howitzers deploys on the Khe Sanh plateau in support of LAMSON 719. Note bomb crater in right foreground.

The 8-inch (203 mm) self-propelled howitzer was considered the most accurate artillery piece used by the Army during the Vietnam War.

A 175 mm self-propelled howitzer supports LAMSON 719 operations.

enemy troops and destroyed more than 20 tanks. The ARVN lost about 200 troops, three tanks and 25 armored personnel carriers.

The airborne troops on FSB 30 held out until 3 March before abandoning the base. Enemy tanks assaulted FSB 30 but could not ascend the sharper slopes of the hill, so they stayed within range and provided direct fire support. Despite massive U.S. air power and artillery support that could be brought to bear in the areas north of FSBs 30 and 31, the enemy had created "no go" terrain for helicopters and most fixed wing airplanes. By sheer numbers in troops and firepower the enemy had the ability and audacity to move troops, tanks and vehicles in the open. Even with three divisions' worth of air assets in the 101st Airborne Division, all of the Air Force, Navy and Marine tactical aircraft, and dozens of B-52 strikes, the enemy had more firepower over most of the area of operation than could possibly be suppressed. Targets of opportunity were everywhere.

For nearly 3 weeks the armored column at A LUOI quite honestly "dragged its tracks." It was clear with the deteriorating situation north of A LUOI, that the column could not advance toward Tchepone. Instead, it was directed to remain in a defensive role and an air assault was planned to reach the Tchepone objective.

On 2 March ARVN Marine units were airlifted to FSBs DELTA and HOTEL to relieve the 1st Infantry's troops. On 3 March a battalion of 1st Infantry troops was helicopter assaulted into LZ LOLO. This was one of the darkest days in Army Aviation history. Eleven UH-1 Huey aircraft where shot down in the immediate area of the LZ that day, and some 35 UH-1s received combat damage. The air mission commander actually instructed the follow-on aircraft to, "Land to the burning aircraft!" that fateful day. Despite the losses, Army Aviation completed the mission to establish an FSB at the LOLO location. By 5 March the string of LZs and FSBs along the escarpment south of Route 9 and the Xepon River was complete. These included FSBs SOPHIA WEST and DELTA 1 along with LZs LOLO, LIZ and BROWN.

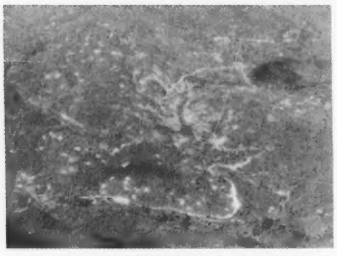
The FSBs and LZs along the escarpment provided the ground track for most helicopters to fly back and forth conducting resupply, combat assaults and aeromedical evacuation. These bases also provided the path for withdrawal after the assault on Tchepone. FSB SOPHIA WEST with its eight artillery pieces was also within range of the Tchepone area.

The 6th of March started as a beautiful, clear blue day. B-52s changed that by pounding the Tchepone area that morning. That afternoon, two battalions of the ARVN 1st Infantry Division were airlifted into LZ HOPE near Tchepone on the largest helicopter combat assault in the history of Army Aviation! An armada of 120

A 174th Assault Helicopter Company UH-1C "Charlie" model gunship refuels at Khe Sanh. The gun platoon of this unit was called the "Sharks."

UH-1s departed Khe Sanh in a single-ship, 30-second separation formation on the 50+ mile round trip. A score of helicopter gunships and fixed wing, tactical aircraft flanked the UH-1s on that assault. Only one helicopter was shot down on an approach into LZ HOPE with a few others receiving "hits" from enemy fire.

On the ground, ARVN troops encountered little resistance and Tchepone was occupied for a few days. In the wake of the B-52s' powerful strikes, ARVN troops counted hundreds of North Vietnamese killed. A virtual "mountain" of food, supplies and weapons was also captured or destroyed. On 10 March units operating from LZ HOPE linked up to the south with units from SOPHIA WEST. This marked the end of Phases II and III and the beginning of Phase IV. Recall that Phase III was the exploitation phase during which search and destroy operations were conducted by units around their respective LZs and FSBs. Such operations were ongoing throughout Phase II.



The Ho Chi Minh Trail in Laos winds near the RANGER fire support bases. Bomb craters, mostly from B-52 strikes, are visible along the roads and especially by a river crossing point.

Phase IV: The Withdrawal. Withdrawal from positions along the escarpment and on Route 9 was accomplished on foot and by helicopter extractions. From 11 to 14 March units from SOPHIA WEST and LIZ were extracted to SOPHIA EAST and DELTA 1. By this time viturally all of the fixed locations of ARVN troops were in frequent contact with the Communists whose antiaircraft emplacements were everywhere, intent on defeating efforts to resupply or extract troops. The ARVN needed to execute an orderly withdrawal from a deep attack while under intense enemy pressure. (This is one of the most difficult military maneuvers to conduct.) At this point ARVN troops had little or no artillery support of their own. Many of their units were running dangerously low on ammunition, and the troops were very fatigued.

To complete extractions under enemy contact, most ARVN units had to move their locations at night. They had to break contact with the enemy and then find a suitable pickup zone (PZ) where extractions were feasible. Frequently, extractions could only be completed after or during intense artillery, helicopter gunship and tactical air support. By 18 March ARVN units, with mounting losses, had withdrawn east on the escarpment south of A LUOI.

On 19 and 20 March evacuation of armor and airborne units commenced with the closing of A LUOI. The armored columns moved east along Route 9 without too much difficulty until reaching FSB BRAVO where they ran into a Communist blockade, ambushes and tanks.

From 20 through 22 March the last armored columns on Route 9 tried to return to Khe Sanh, but most were ambushed and destroyed. This marked the end of the Route 9 withdrawal except for stragglers who managed to come through during the next day or so.

On the escarpment, all ARVN 1st Infantry Division troops were extracted by 21 March, but not before Army Aviation became engaged in intense combat the day before. While making repeated

flights to extract ARVN troops from PZ BROWN, 10 UH-1H helicopters were shot down. About 50 more received combat damage. Once again Army Aviation was put to the ultimate test. It took serious losses, but completed its mission!

The ARVN Marines were the last units left on the escarpment at FSBs DELTA and HOTEL. On 20 and 21 March a brigade on FSB DELTA came under continuous attack. Four times combined human wave and tank attacks were repulsed with the aid of U.S. artillery and air support to include close-in B-52 strikes. North Vietnamese tanks and high troop concentrations appeared everywhere along Route 9 and on the escarpment.

On 22 March the ARVN Marines were finally driven off of FSB DELTA by flame-throwing tanks. The next day as many Marine units as possible were extracted from Laos and on 24 March the last elements of ARVN troops were extracted from FSB HOTEL. LAMSON 719 ended with a tremendous show of North Vietnamese firepower, stopping short of advancing into South Vietnam toward Khe Sanh to continue the battle. LAMSON 719 fighting continued up to 6 April, but after 24 March only a couple of 1-day raids were conducted into BASE AREA 611 with little casualties or consequence.

The escarpment south of Route 9 in Laos is surrounded by dense jungle, sharp cliffs, mountains and plateaus that made the battle area a place not easily forgotten.

An abandoned Montagnard (Mountainyard) village on the escarpment near LZ Delta in Laos. The ridgeline overlooks the valley where the Xepon River and Route 9 are located.

LZ Brown on the escarpment in Laos overlooks the Xepon River and Route 9.

Battle Facts and Statistics

Throughout LAMSON 719, Army Aviation units continued to encounter intense enemy antiaircraft fire while resupplying troops and extracting the wounded and dead. Most approaches to LZs along the escarpment and on Route 9 received heavy fire going in. In the LZs, the aircraft received mortar and small arms fire as well as occasional artillery barrages. But the worst part of the gauntlet came when the UH-1 Hueys would depart the LZs and attempt to climb out. Then a droning fusilade of fire would be unleashed from several locations, making it difficult to maneuver away from the fire.

The most frequently used and frightening antiaircraft weapons the Hueys encountered were the 12.7 mm or 50 caliber machineguns. These weapons had a distinctive sound and fired tracers every few rounds, which looked like bas-

ketballs or pumpkins coming at the aircraft. Even with two and four gunships for support and occasional tactical fighters, some sorties could not be completed. Toward the end of the operation, the North Vietnamese altered their strategy by letting some aircraft make approaches without being shot at, then suddenly unleashing mortar, artillery and antiaircraft barrages at the helicopters upon landing and taking off. At times more than 20 ARVN soldiers would be lifted out by straining UH-1Hs, with soldiers clinging to the skids. Media portrayals of these incidents were used as proof that the South Vietnamese had been "routed" from Laos.

Weather was a serious problem, hindering LAMSON 719 operations. Most aircraft were stationed on the coast more than a half-hour flight to Khe Sanh in a UH-1. Refueling and staging was done mainly at Khe Sanh or FSB VANDERGRIFT. Bad weather over Laos, Khe Sanh or the coast too often caused delays or cancellation of missions, occasionally at critical moments during the battle.

Results of the LAMSON 719 operation brought criticism from some about the concepts of airmobility and fire support bases. ARVN troops were unable to effectively patrol around their FSBs and thereby failed to prevent enemy hugging tactics. Successful patrol was necessary to provide security for helicopter operations. Also, fixed positions engaging superior enemy firepower were questionable and provided a distinct disadvantage in counterbattery fire—a common occurrence during LAMSON 719. The Communists had greater mobility, familiarity with the area, and longer artillery standoff ranges than the ARVN. Hence, greater mobility in the deep attack probably would have been more serviceable. While the concept of airmobility may have been questioned, a review of the battle statistics shows that Army Aviation could perform its mission in a mid-intensity conflict, which includes heavy concentration of antiaircraft fire (figures 4 and 5). In such an environment, a significant loss of aircraft and people was inevitable! However, considering the number of sorties, the loss rate was remarkably low.

LEFT: Remains of a Russian tank destroyed in a battle during LAMSON 719 near the Laos and South Vietnam border, just south of Route 9.

BELOW: An AH-1G gunship is hit by gunfire and autorotated to a field near Route 9 in Laos. South Vietnamese track vehicles soon arrived to provide security and rescue the crewmembers.

The outcome of LAMSON 719 on the ground was questionable. But the successful performance of Army Aviation supporting a deep attack as a maneuver element of a combined arms team (which included an allied force) proved the concept of airmobility without doubt. The North Vietnamese knew well the four employment principles of air defense: mix, mass, mobility, and integration. But, Army Aviation countered enemy efforts more times than not.

The significance and success of the helicopter on the mid-intensity, mobile battlefield finally proved the helicopter's unique capabilities that had until then only been anticipated/conceptualized, never before proven in combat. An attack of such magnitude never could have been accomplished from start to finish in just 45 days without the airmobility capabilities of the helicopter. Without U.S. firepower and airmobility tactics, a deep attack into the Communist's most-defended base areas (which incorporated intense enemy firepower and large troop concentrations) would have been foolhardy. The result would be little success and probable casualty rates in excess of the near 45 percent level experienced by the ARVN task force.

LAMSON 719 was different from overall operations in South Vietnam, and also different from current tactical doctrine in Army

Aviation. Throughout South Vietnam, helicopters generally operated in a low-intensity antiaircraft fire environment. Helicopters usually were only sporadically engaged, primarily with just small arms fire. During combat assaults, gunship support was often successful in suppressing enemy fire.

Even up to the standdowns in 1972, low level (nap-of-the-earth) flying was prohibited and viewed as unsafe. Aircraft were supposed to fly at 1,500 feet above ground level in Vietnam and at least 3,000 feet above ground level in Laos and Cambodia.

On single helicopter missions, tight circling approaches and climbouts were typical for getting into and out of LZs. Multiship combat assaults also conformed to the altitude restrictions and usually were conducted in lifts of UH-1s in tight formations to get as many aircraft as possible into a PZ/LZ. Usually one gunship team of two helicopters would provide fire support around a PZ/LZ by flying a racetrack pattern on one side of the flight at an altitude 500 to 1,000 feet above ground level.

In Vietnam such tactics were successful, but in Laos they were disastrous. Before the end of LAMSON 719 single helicopter sorties were routinely flown at low level; combat assaults were conducted by single ship landings with 30-second separations, and gunships made runs from higher altitudes. The LAMSON 719 battle did more than any other operation in the history of the Vietnam War to revert Army Aviation doctrine to the development of nap-of-the-earth flight tactics (such as were being developed at the Aviation Center, Ft. Rucker, AL, in the late 1950s and early 1960s). Also Vietnam helicopter tactics were moved away from close formation combat assaults!

Who really won the LAMSON 719 battle? Both sides claimed victory, but a review of the major objectives of the operation showed that it was more of a success for the South Vietnamese. They did interdict into Laos and disrupt the flow of enemy troops and supplies along the Ho Chi Minh Trail. In fact, because of this campaign, it was more than 1 year before North Vietnam launched any significant offensives in the south.

LAMSON 719 revealed some serious flaws, particularly in the Vietnamization effort. The ARVN force was not sufficient in size, and it was a long way from being able to provide its own air and firepower to thwart the determined Communist aggression.

Despite the Communist losses, the significant losses sustained by ARVN troops damaged the morale and confidence of the South Vietnamese. In particular, the Vietnamese people were shocked and hurt that so many dead and wounded were never extracted from the battlefield. Recall that the Vietnamese culture was dominated by ancestor worship: Failure to return the bodies of fallen soldiers accentuated the grief of family members.

LAMSON 719 was supposed to last up to 90 days instead of only 45 days. Clearly, the Communist's significant counterattacks shortened the duration of the operation. Finally, within a week after the battle, Communist activity on the Ho Chi Minh Trail had resumed with its usual earnest, never to be seriously threatened again.

The final battle tallies and aviation statistics were taken from the 101st Airborne Division (Airmobile) afteraction report (April to May 1971). The afteraction report was declassified after 12 years (Department of Defense Directive 5200.10). The casualty numbers shown in figure 4 are based on the total troops committed in LAMSON 719. Official dates given for aviation statistics were 8 February to 24 March 1971, or 45 days. Damage and loss statistics for the Army Aviation rotary wing assets committed to the operation are shown in figure 5.

Next month LAMSON 719 coverage concludes with "Part III: Reflections and Values." In it, the lessons learned from LAMSON 719 will be summarized.

	Killed in action	Wounded in action	Missing in action	Equipment Lost (excluding aircraft)
U.S.	102	215	53	(none in Laos)
RVN	1,146	4,236	246	71 tanks 96 artillery 278 trucks
	45% casualty rate for committed troops in Laos.			
NVA	14,000	Unknown	Unknown	100 tanks 290 trucks
	Estimated 50% casualty rate.			

FIGURE 4: Casualty Statistics.

Aircraft	Total Aircraft	Aircraft Damaged	Damage Incidents	Aircraft Lost	Percentage Lost
OH-6A	59	22	34	6	10
UH-1C	60	48	66	12	20
UH-1H	312	237	344	49	16
AH-1G	117	101	152	18	15
CH-47	80	30	33	3	4
CH-53	16	14	14	2	13
CH-54	10	1	1	0	0
OH-58	5	No Data	No Data	No Data	No Data
TOTAL	659	453	644	90	14

FIGURE 5: Helicopter Damage and Loss Statistics.

ANNUAL WRITING AWARDS

January

Threat: Closing the Window
Mr. Edward J. Bavaro

February

Price Tag of Survival
CW3 E. Daniel Kingsley

March

Aircraft Survivability Equipment Trainers
CW4 Perry M. Smith

April

Cobra Gold 85
CPT Christopher A. Acker

May

Against All Odds—Theoretical Aspects of Microburst Flight
LCDR Joseph F. Towers

June

LAMSON 719
CPT Jim E. Fulbrook, Ph.D.

July

Dehydration, Heat Illness and Army Aviation
MAJ Glenn W. Mitchell, M.D.
CPT Robert W. Weien, M.D.

August

ERADCOM—Electronic Warfare Laboratory and Signals Warfare Laboratory
CPT (P) Greg Kaufmann

September

Air Assault—The Cross-FLOT Raid
CPT John F. Murphy

October

AVRADA
MAJ (P) Cornelius J. Westerhoff

November

Soviet Air Assault Brigade, Part I: Origins
COL Jack E. Easton
MAJ (P) Charles B. Cook

December

First Chinook Aerial Refueling
MAJ (P) Charles (Chuck) F. Nowlin

1st Maj. Glenn W. Mitchell, M.D.
Cpt. Robert W. Weien, M.D.

2d CW3 E. Daniel Kingsley

3d LCDR Joseph F. Towers